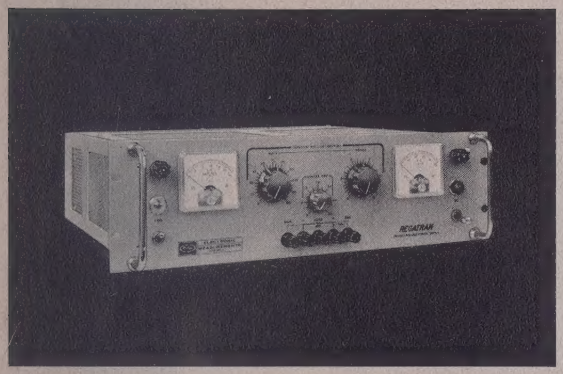
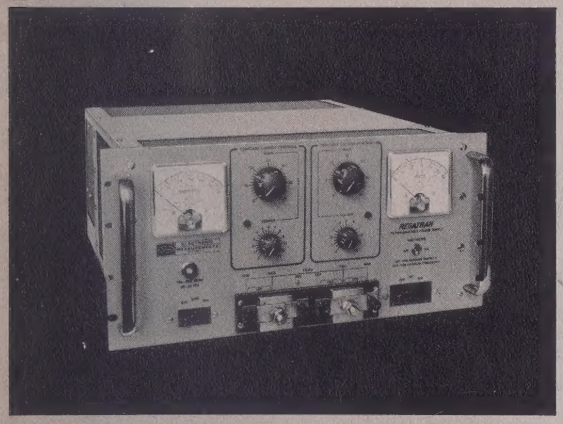
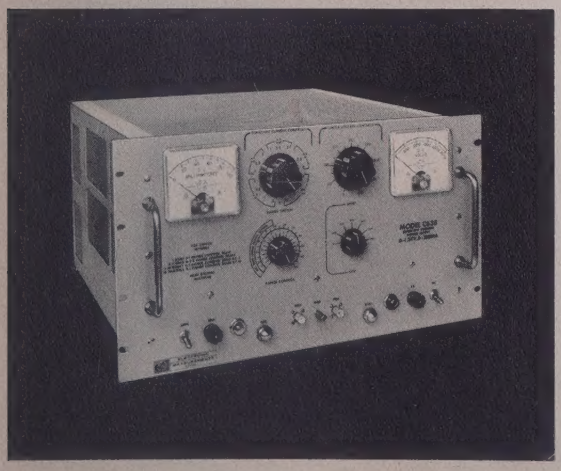
GENERAL CATALOG / JUNE 1964







ELECTRONIC
MEASUREMENTS
COMPANY, INCORPORATED
EATONTOWN · NEW JERSEY

POWER SUPPLY LOCATOR

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Established in 1940, Electronic Measurements is the original, exclusive manufacturer of wide-range, regulated power supplies. In this field, Electronic Measurements has made many important contributions. Some of these contributions, such as programming, are so well known in the industry that they are associated with the trade names ®Regatron and ®Regatran, both registered trademarks of Electronic Measurements.

From its beginnings in a single plant in Eatontown, New Jersey, Electronic Measurements now occupies four different facilities. The most unique is an engineering building that houses Electronic Measurements' complete engineering staff. This facility has every modern engineering convenience, including an esiac computer. It is the only such facility dedicated exclusively to power supply design.

Standards are maintained in a specially constructed room in the engineering building. A controlled atmosphere is maintained 24 hours a day in this room. All standards are traceable to the Bureau of Standards.

Items listed in this catalog are manufactured under one or more U.S. Patents issued or pending.

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For actual specifications, see descriptive data on pages given in table headings.
★—STANDARD O—OPTIONAL C—CERTAIN MODELS

Feature	PVC Series Page 4	PV Series Page 6	HV Series Page 8	Half Rack Series Page 10	T0 Series Page12	C600 Series Page 14	200 Series Page 18	Calibrated Output Series Page 20	General Utility Series Page 21
CONSTANT VOLTAGE MODELS									
0—1500V							★		
0—1000V								★	
0— 600V							★	★	
0— 500V									★
0— 400V			★						
0— 330V			★						
0— 325V									★
0— 300V			★				★	★	
0— 200V							★		
0— 150V			★				★		
0— 100V				★	★		★		
0— 75V							★		
0— 60V	★	★		★	★				
0— 50V					★		★		
0— 40V				★					
0— 36V	★	★		★	★				
0— 32V		★							
0— 20V	★			★					
0— 18V				★					
0— 16V					★				
0— 14V					★				
0— 10V					★				
0— 6V					★				
CONSTANT CURRENT MODELS									
0— *A	★								
0— 100A	★								
0— 60A	★								
0— 30A	★	★							
0— 15A	★	★							
0— 10A		★							
0— 7.5A	★	★							
0— 5A		★							
0— 4A									
0— 3A						★			
0— 2.5A		★							
0— 2A						★			
0— 1.5A									
0— 1A						★			
0— 500MA						★			
0— 300MA						★			
0— 220MA						★			
0— 200MA									
0— 100MA						★			
AUTO. E/I CROSSOVER	★	★	★	★		★			
1. Dual Channel	★								
2. Current Control	★	★	★	★		★			
3. Voltage Control	★	★	★	★	★	★	★	★	★
PROGRAMMABLE	★	★	★	★	C	★	★		
MHOGRAMMABLE	★	★	★	O	O		O		
REMOTE SENSING	★	★	★	★	★		★		
SERIES OR PARALLEL OPERATION	★	★	O	O					
EXTERNAL REFERENCE PROVISION	★	★	★				C	C	
SOLID STATE	ALL SILICON	★	★	★	★				
MODULATION INPUT						★	C	C	

*Higher currents available, request information from factory.

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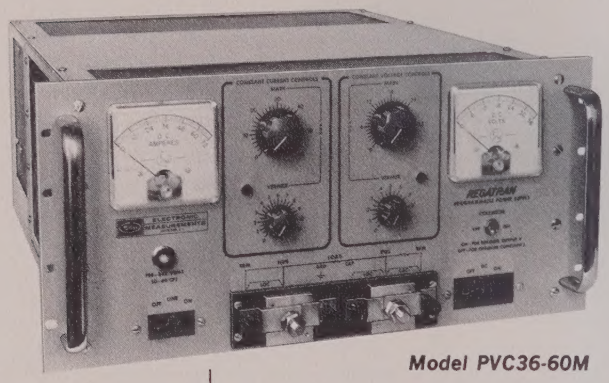
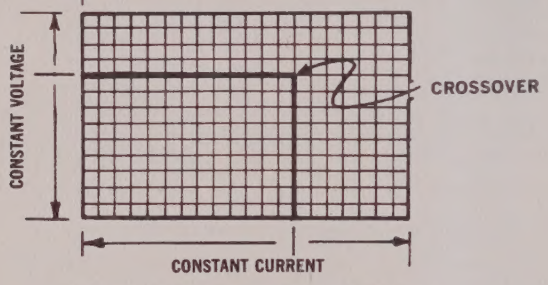
Regatran® "PVC" Power Supplies

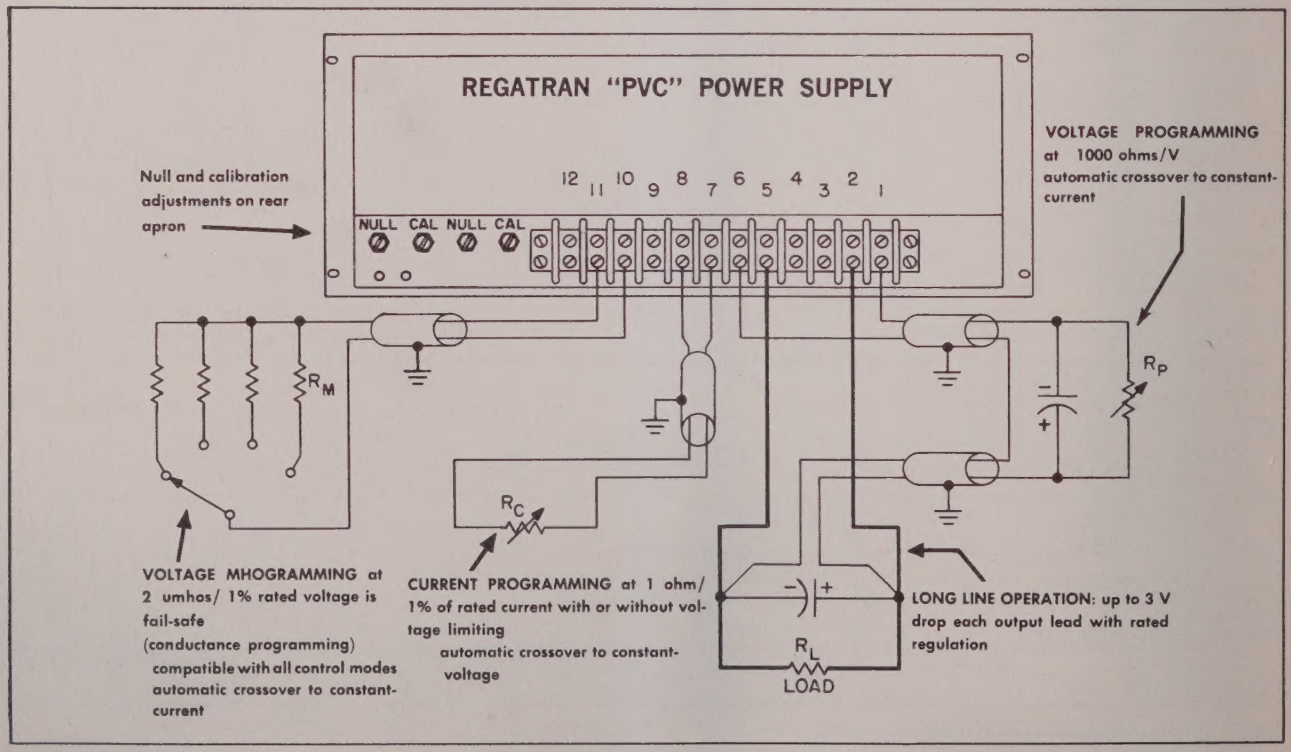


Model PVC36-60M



Automatic Crossover Characteristics

- *All-Silicon*
- *Constant Voltage/Constant Current*
- *Two Independent Regulating Systems*
- *Automatic E/I Crossover with Mode Indicators*
- *SCR Input*
- *Long Line Remote Sensing*
- *Master-Slave Series and Parallel Operation*
- *Programmable*
- *Mhogrammable®*
- *No Voltage Overshoot at Turn-On or Turn-Off*
- *Instant Start-Up*


REGATRAN "PVC" POWER SUPPLY
12 11 10 9 8 7 6 5 4 3 2 1
NULL CAL NULL CAL
Null and calibration adjustments on rear apron
VOLTAGE PROGRAMMING at 1000 ohms/V automatic crossover to constant-current
R_M
R_C
R_P
R_L
LOAD
VOLTAGE MHOGRAMMING at 2 umhos/ 1% rated voltage is fail-safe (conductance programming) compatible with all control modes automatic crossover to constant-current
CURRENT PROGRAMMING at 1 ohm/ 1% of rated current with or without voltage limiting automatic crossover to constant-voltage
LONG LINE OPERATION: up to 3 V drop each output lead with rated regulation

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Specifications and Features

PVC SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS				REGULATION[1]				RIPPLE		TRANSIENT RESP.		AC INPUT	WATTS INPUT	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE[3]	MODEL NO.
		VOLTS		AMPS		VOLTAGE		CURRENT		Eo	Io	OUTPUT RECOVERS		50-63 CPS. 1φ A=105-125V B=198-242V							WITH METERS
VOLTS	AMPS	MAIN	FINE	MAIN	FINE	%	MV	%	MA	MV	MA	TO MV	IN μSEC.		APPROX.	H	W	D	APPROX.		2% ACC. F.S.
0-20	0-30	0-20	0-1	0-30	0-6	0.01	2	0.05	8	0.5	4	[5]	[5]	A OR B	924	7	19	15¾	75	$875	PVC20-30M
0-36	0-15	0-36	0-1	0-15	0-3	0.01	2	0.05	8	0.5	2	50	100	A OR B	864	7	19	15¾	75	835	PVC36-15M
0-36	0-30	0-36	0-1	0-30	0-6	0.01	2	0.05	8	0.5	4	50	100	A OR B	1722	8¾	19	18¾	113	975	PVC36-30M
0-36	0-60	0-36	0-1	0-60	0-6	0.01	2	0.05	8	1	12[4]	[5]	[5]	B ONLY	3550	8¾	19	20	148	1625	PVC36-60M
0-36	0-100	0-36	0-1	0-100	0-10	0.01	2	0.05	8	1	12[4]	[5]	[5]	B ONLY	5700	8¾	19	20	153	2525	PVC36-100M
0-60	0-7.5	0-60	0-1	0-7.5	0-1.5	0.01	2	0.05	8	0.5	2	100	100	A OR B	794	7	19	15¾	75	845	PVC60-7.5M
0-60	0-15	0-60	0-1	0-15	0-3	0.01	2	0.05	8	0.5	4	100	100	A OR B	1540	8¾	19	18¾	113	995	PVC60-15M
0-60	0-30	0-60	0-1	0-30	0-3	0.01	2	0.05	8	1	12[4]	[5]	[5]	B ONLY	2900	8¾	19	20	153	1725	PVC60-30M

[1] % or mv, whichever is greater.
[2] At max. input line voltage.
[3] For basic unit without meters, deduct $25 from price and delete M from model no.
[4] Or 0.02%.
[5] Not available at time of printing.
[6] Approx.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range. Current regulation measured for a step change equal to maximum rated voltage less 6 V anywhere within range.

Line: Voltage and current regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied except for Models PVC36-60M, PVC36-100M and PVC60-30M which are available for 198 to 242 V operation only.

STABILITY:

Voltage: 0.015% +1 MV for 8 hours after warmup under fixed line, load, and temperature conditions.

Current: Consult factory.

TEMPERATURE RANGE:

Operating: 0° to +60° C.

Nonoperating: −40° to +75° C.

TEMPERATURE COEFFICIENT: 0.02% +2 MV per degree C.

OUTPUT IMPEDANCE: Approximately 0.001 ohm at 1 kc; 0.2 ohm at 100 kc; 1 ohm at 1 mc.

PROGRAMMING CONSTANT:

Voltage: 1000 ohms per volt.

Current: 1 ohm per 1% of maximum current.

MHOGRAMMING CONSTANT: 2 micromhos per 1% of maximum voltage.

OVERLOAD PROTECTION: Fused ac input and dc output on 5, 10, and 15 A models. Circuit breakers on higher-current models.

SPECIAL CAPABILITIES

LONG LINE REMOTE SENSING: Maintains regulation of 0.05% or 10 MV, whichever is greater, at remote load with as much as a 3 V IR drop per load lead. Regulation improves proportionately to 0.01% or 2 MV as IR drop decreases. Subtract voltage losses due to IR drop from output voltage at power supply terminals.

SERIES AND PARALLEL OPERATION: Master-slave, series or parallel operation, permits stacking two or more power supplies for additive outputs. Slave units operate in accordance with master-unit control settings (local or programmed).

PROGRAMMABLE: All models are programmable from zero to maximum rated voltage and from zero to maximum rated current. Voltage and current outputs are remotely controlled by separate elements through independent regulator systems.

MHOGRAMMABLE: All models are Mhogrammable from zero to maximum rated voltage at zero to maximum rated current. Specifications apply from 10% to 100% of rated voltage.

AUTOMATIC CROSSOVER: Constant voltage crosses over automatically to constant current, or vice versa. Two independent regulators with sharp autocrossover from one mode to the other.

EXTERNAL REFERENCE: Rear terminals provide for substituting external reference voltage for internal reference voltage.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber or stainless steel feet for table use.

CIRCUITRY: All silicon semiconductors.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

ADJUSTMENTS: Null and calibration screwdriver adjust controls on rear panel.

TERMINATIONS: Unless specified otherwise, both front and rear terminals are supplied. Rear only, if specified. Front only, not available.

Front: Six insulated 5-way binding posts except for 60 and 100 A models, which have 4 binding posts, and 2 insulated brass studs for POS and NEG outputs.

Rear: Barrier-type with terminals for all modes of operation except 60 and 100 A models, which have insulated brass studs for POS and NEG outputs.

Line Cord: 3-conductor type, except Models PVC36-100, PVC36-60 and PVC60-30 which are provided with three-terminal barrier strip for ac input connections.

MODE INDICATORS: Visual indicator (CV or CC) panel lights to show mode of operation. As mode changes, one indicator is extinguished and the other lights.

COOLING: Forced air cooling. Five-year, maintenance-free fan motors employed.

ACCESSIBILITY: All models have removable top and bottom covers and plug-in transistor heat sink assemblies.

FINISH: Smooth, gray, semigloss enamel; Class 2 per MIL-E-15090. Black, red, and green screened panel markings.

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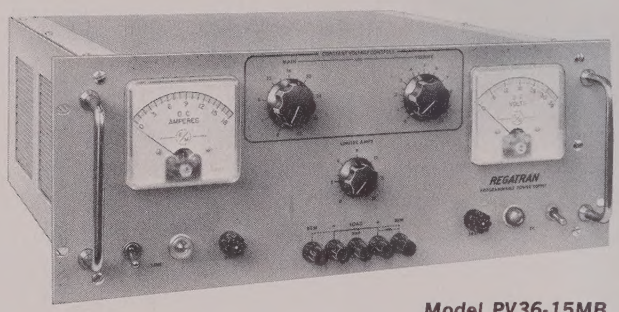
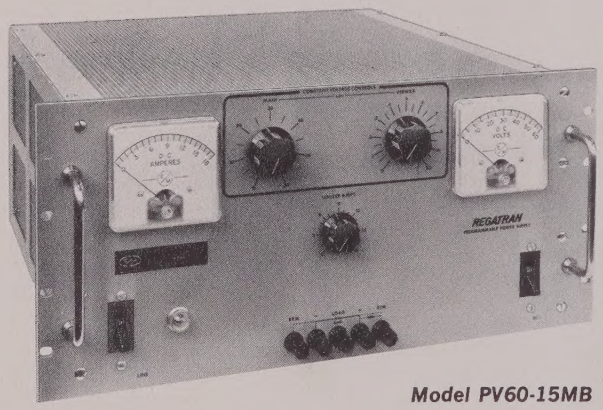
Regatran® "PV" Power Supplies

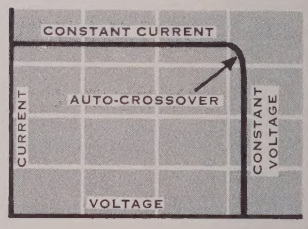


Model PV36-15MB

- *Constant Voltage/Constant Current*
- *Automatic E/I Crossover*
- *Solid-State, SCR Input*
- *Long Line Remote Sensing*
- *Programmable*
- *Mhogrammable®*

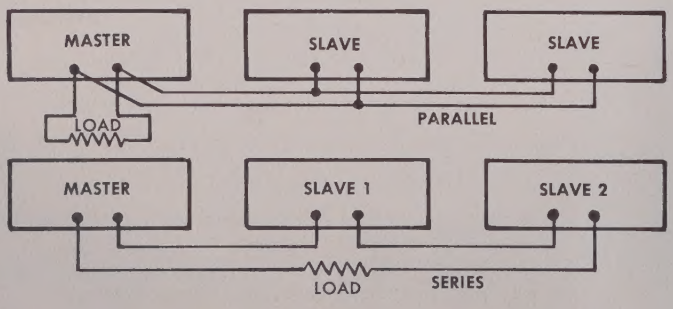


Model PV60-15MB



Automatic Crossover Characteristics

MASTER-SLAVE SERIES OR PARALLEL OUTPUTS . . . constant-voltage or constant-current



Electronic Measurements PV Power Supplies can be connected in series or parallel to obtain greater voltage or current. In such combinations, as shown at left, one power supply serves as the master; the others are slaved to its sensing and control system.

PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

Specifications and Features

PV SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS			REGULATION[1]										RIPPLE		TRANSIENT RESPONSE		AC INPUT	WATTS[2] INPUT	DIMENSIONS			WEIGHT IN LBS.	PRICE[3,4]	MODEL NO.
					CONSTANT E		CONSTANT CURRENT														DEPTH MEASURED BEHIND PANEL					
					W/I LIMITING		WITH E LIMITING				WITHOUT E LIMITING															
		VOLTS		AMPS	LINE OR LOAD		LINE		LOAD		LINE		LOAD		Eo	Io	OUTPUT RECOVERS		50-63 CPS, 1ϕ A=105-125V B=198-242V							WITH METERS
VOLTS	AMPS	MAIN	FINE	MAIN	%	MV	%	MA	%	MA	%	MA	%	MA	MV	MA	TO MV	IN μSEC		APPROX.	H	W	D	APPROX.		2% ACC. F.S.
0-32	0-5	0-32	0-1	0-6	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	266	3½	19	17¼	36	$420	PV32-5M
0-32	0-10	0-32	0-1	0-12	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	564	5¼	19	16½	52	550	PV32-10M
0-32	0-15	0-32	0-1	0-18	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	824	7	19	15¾	75	685	PV32-15M
0-32	0-30	0-32	0-1	0-36	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	3	400	200	A OR B	1602	8¾	19	18	120	855	PV32-30M
0-36	0-5	0-36	0-1	0-6	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	286	3½	19	17¼	36	450	PV36-5M
0-36	0-10	0-36	0-1	0-12	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	604	5¼	19	16½	52	575	PV36-10M
0-36	0-15	0-36	0-1	0-18	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	884	7	19	15¾	75	715	PV36-15M
0-36	0-30	0-36	0-1	0-36	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	3	400	200	A OR B	1722	8¾	19	18	120	875	PV36-30M
0-60	0-2.5	0-60	0-1	0-3	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	236	3½	19	17¼	36	460	PV60-2.5M
0-60	0-5	0-60	0-1	0-6	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	544	5¼	19	16½	52	600	PV60-5M
0-60	0-7.5	0-60	0-1	0-9	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	2	200	200	A OR B	794	7	19	15¾	75	745	PV60-7.5M
0-60	0-15	0-60	0-1	0-18	0.01	2	0.06	3	0.25	20	0.06	3	0.1	10	½	3	200	200	A OR B	1542	8¾	19	18	120	895	PV60-15M

[1] % or mv, whichever is greater.
[2] At max. input line voltage.
[3] For basic unit without meters, deduct $25 from price and delete M from model no.
[4] Rear terminals standard. Front only not available. For front and rear terminals add B to model no. and $5 to price.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range. Current regulation measured for a step change equal to maximum rated voltage less 6 V anywhere within range.

Line: Voltage or current regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied.

STABILITY:

Voltage: 0.02% +1 MV for 8 hours after warmup under fixed line, load, and temperature conditions.

Current: Consult factory.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

TEMPERATURE COEFFICIENT: 0.02% +2 MV per degree C.

OUTPUT IMPEDANCE: Approximately 0.001 ohm at 1 kc, 0.2 ohm at 100 kc, 1 ohm at 1 mc.

PROGRAMMING CONSTANT:

Voltage: 100 ohms per volt is standard. 1,000 ohms per volt is optional extra.

Current: Approximately 1.25 ohms per 1% of rated current.

MHOGRAMMING CONSTANT: 20 micromhos per 1% of rated voltage.

OVERLOAD PROTECTION: Fused ac input and dc output on 5, 10, and 15 A models. Circuit breakers on higher-current models.

SPECIAL CAPABILITIES

LONG-LINE REMOTE SENSING: Maintains regulation of 0.1% or 20 MV, whichever is greater, at remote load, with as much as a 3 V IR drop per load lead. Regulation improves proportionately to 0.01% or 2 MV as IR drop decreases. Subtract voltage losses due to IR drop from output voltage at power supply terminals.

SERIES AND PARALLEL OPERATION: Master-slave, series or parallel operation, permits stacking two or more power supplies for additive outputs. Slave units operate in accordance with master-unit control settings (local or programmed).

PROGRAMMABLE: All models are programmable from zero to maximum rated voltage and from zero to maximum rated current.

MHOGRAMMABLE: All models are Mhogrammable from zero to maximum rated voltage at zero to maximum rated current. Specifications apply from 10% to 100% of rated voltage.

AUTOMATIC CROSSOVER: Constant voltage crosses over automatically to constant current, or vice versa.

EXTERNAL REFERENCE: Rear terminals provided for substituting external reference voltage for internal reference voltage.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

ADJUSTMENTS: Null and calibration screwdriver adjust controls on rear panel.

TERMINATIONS: Unless specified otherwise, rear terminals are supplied. Both front and rear terminals are available if specified. Front only, not available.

Front: Insulated, 5-way binding posts.

Rear: Barrier-type terminal strips.

Line Cord: 3-conductor type.

COOLING: Forced air except Models PV32-5M, PV36-5M, and PV60-2.5M which are convection cooled. Forced air models employ 5-year, maintenance-free fan motors.

ACCESSIBILITY: All models have removable top and bottom covers. Forced air-cooled models have plug-in transistor heat sink assemblies.

FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black, red, and green screened panel markings.

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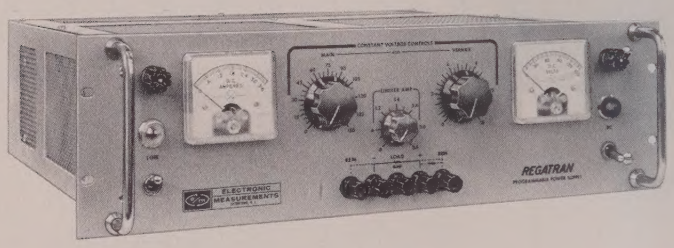
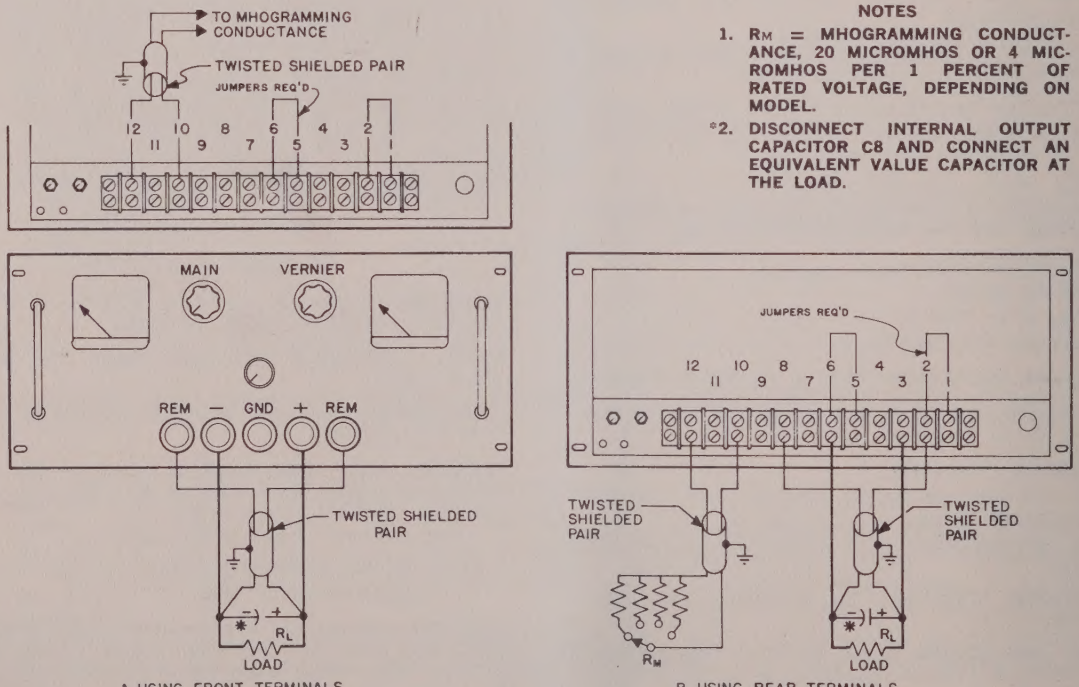
Regatran® "HV" Power Supplies



Model HV150-3M

- *Constant Voltage/Current Control*
- *Automatic E/I Crossover*
- *All Solid-State*
- *Programmable*
- *Mhogrammable®*
- *3½" and 5¼" Panel Heights*
- *Up to 400 V at 1 A*
- *Instant Start-Up*



NOTES

1. R_M = MHOGRAMMING CONDUCTANCE, 20 MICROMHOS OR 4 MICROMHOS PER 1 PERCENT OF RATED VOLTAGE, DEPENDING ON MODEL.
*2. DISCONNECT INTERNAL OUTPUT CAPACITOR C8 AND CONNECT AN EQUIVALENT VALUE CAPACITOR AT THE LOAD.

Connections for Mhogramming with remote sensing. Note that connections can be made at front or rear. Other connections can be made for other operating modes, such as programming, etc.

PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

HV SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS			REGULATION[1]		RIPPLE	TRANSIENT RESP.		AC INPUT	WATTS[2] INPUT	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE[3]	MODEL NO.
		VOLTS		AMPS	(LINE OR LOAD)			OUTPUT RECOVERS		50-63 CPS, 1φ A=105-125 V B=198-242 V					APPROX.		WITH METERS 2% ACC. F.S.
VOLTS	AMPS	MAIN	FINE	MAIN	%	MV	MV	TO MV	IN μSEC.		APPROX.	H	W	D			
0-150	0-2	0-150	0-15	0-2.4	0.03	5	1	50	100	A OR B	427	3½	19	15¾	40	$590	HV150-2M
0-150	0-3	0-150	0-15	0-3.6	0.03	5	1	50	100	A OR B	605	5¼	19	17	49	620	HV150-3M
0-300	0-1.5	0-300	0-30	0-1.8	0.03	5	1	50	100	A OR B	616	5¼	19	17	49	620	HV300-1.5M
0-330	0-1	0-300	0-30	0-1.2	0.03	5	1	50	100	A OR B	472	3½	19	15¾	40	590	HV330-1M
0-400	0-1	0-400	0-20	0-1.2	0.03	5	1	50	100	A OR B	570	5¼	19	17	49	720	HV400-1M

[1] % or mv, whichever is greater.
[2] At max. input line voltage.
[3] For basic unit without meters, deduct $25 from price and delete M from model no.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range with current control at not less than 20% of full rating above maximum anticipated working current.

Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied.

STABILITY: 0.05% +5 MV for 8 hours after warmup under fixed line, load, and temperature conditions.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

TEMPERATURE COEFFICIENT: 0.05% +4 MV per degree C.

OUTPUT IMPEDANCE: Approximately 0.02 ohm at 1 kc, to 0.3 ohm at 100 kc.

PROGRAMMING CONSTANT:

Voltage: 100 ohms per volt, except for HV400-1, which is 500 ohms per volt.

Current: 1 ohm per 1% of maximum rated current.

MHOGRAMMING CONSTANT: 20 micromhos per 1% of maximum rated voltage, except for HV400-1 which is 4 micromhos per 1% of maximum rated voltage.

OVERLOAD PROTECTION: Current limiting. Fused input and dc output lines. Series system electronically protected from burnout.

SPECIAL CAPABILITIES

REMOTE SENSING: All models permit load connections with sensing for compensation of IR drop up to ½ volt in positive and negative output leads with regulation at load.

SERIES AND PARALLEL OPERATION: Optional extra; consult factory. Master-slave, series or parallel operation permits stacking two or more power supplies for additive outputs. Slave units operate in accordance with master-unit control settings (local or programmed).

PROGRAMMABLE: All models are programmable from zero to maximum rated voltage at zero to maximum rated current.

MHOGRAMMABLE: All models are Mhogrammable from zero to maximum rated voltage at zero to maximum rated current. Specifications apply from 10% to 100% of rated voltage.

EXTERNAL REFERENCE: Rear terminals provide for substituting external reference voltage for internal reference voltage.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

ADJUSTMENTS: Null and calibration screwdriver adjust controls on rear panel.

TERMINATIONS: Unless specified otherwise, both front and rear terminals are supplied. Front only, not available. Rear only, if specified.

Front: Insulated 5-way binding posts.

Rear: Barrier-type terminal strips.

Line cord: 3-conductor type.

COOLING: Convection type.

ACCESSIBILITY: All models have removable top and bottom covers.

FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black, red, and green screened panel markings.

Model HV150-2M

Regatran HV Power Supplies are extremely compact. The 330 V, 1A model and the 150 V, 2A model (shown at left) take only 3½" of panel height.

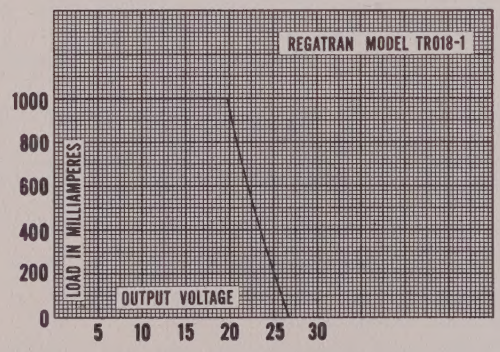
ELECTRONIC
MEASUREMENTS
COMPANY, INCORPORATED
EATONTOWN · NEW JERSEY

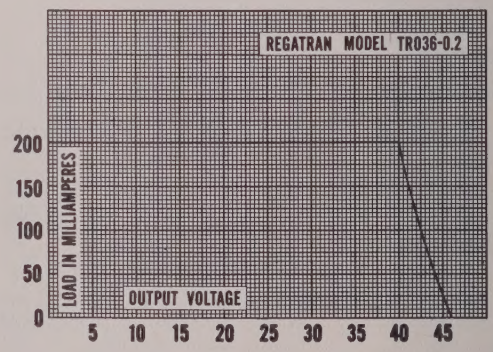
®Regatran Half-Rack "TR" and "PR" Power Supplies

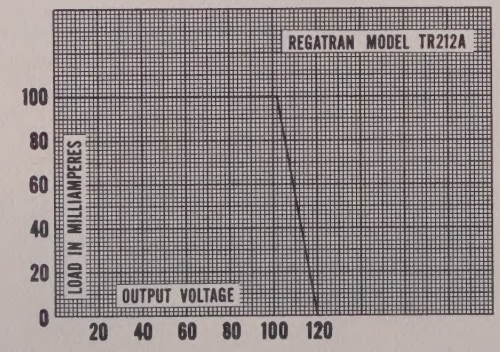
- *Constant Voltage/Current Control*
- *Automatic E/I Crossover*
- *All Solid-State*
- *Programmable*
- *Compact Half-Rack Design*

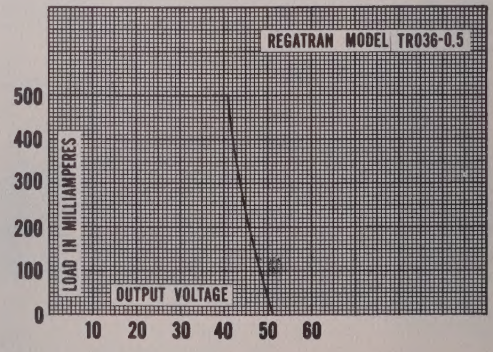
Model TR018-1 M

OVERVOLTAGE CAPABILITY









PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

Specifications and Features

HALF-RACK SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS			REGULATION	RIPPLE	TRANSIENT RESPONSE		AC INPUT 50-63 CPS, 1φ A=105-125V B=198-242V	WATTS[1] INPUT	DIMENSIONS (DEPTH MEASURED BEHIND PANEL)						WEIGHT IN LBS.	PRICE [2,4]	MODEL NO.[5]
		VOLTS		CURRENT LIMITER			OUTPUT RECOVERS				HALF RACK			PORTABLE					
VOLTS	AMPS	MAIN	FINE			μV	TO MV	In μSEC		APPROX.	H	W	D	H	W	D	APPROX.		WITH METERS 2% ACC. F.S.
0-18	0-1	0-18	0-1	200-1.25A	0.04% OR 3MV, WHICHEVER IS GREATER, LINE OR LOAD	250	40	50	A OR B	62	3½	9½	10¼	5	7½	6¼	9	$154[3]	TR018-1M
0-36	0-0.2	0-36	0-1	30-280MA		150	36	50	A OR B 50-420 cps.	24	3½	9½	10¼	5	7½	6¼	7½	149[3]	TR036-0.2M
0-36	0-0.5	0-36	0-1	100-650MA		250	40	50	A OR B	60	3½	9½	10¼	5	7½	6¼	9	160[3]	TR036-0.5M
0-100	0-0.1	0-100	0-10	15-150MA		250	100	50	A OR B	53	3½	9½	10¼	5	7½	6¼	9	184[3]	TR212AM
0-100	0-0.2	0-100	0-10	30-280MA		250	100	90	A OR B	78	3½	9½	10¼	5	7½	6¼	10	240[3]	TR224AM
0-20	0-4	0-20	0-1	0-4.8A		1MV	50	150	A OR B	135	3½	9½	12	3½	8	12	20	250	PR020-4M
0-40	0-2	0-40	0-1	0-2.4A		1MV	50	125	A OR B	132	3½	9½	12	3½	8	12	20	250	PR040-2M
0-60	0-1.5	0-60	0-1	0-1.8A		1MV	50	100	A OR B	148	3½	9½	12	3½	8	12	20	250	PR060-1.5M
0-100	0-1	0-100	0-10	0-1.2A		1MV	50	100	A OR B	165	3½	9½	12	3½	8	12	20	250	PR0100-1M

[1] At max. input line voltage.
[2] For basic unit without meters, delete M from model no. and deduct $25 from price.
[3] Front terminals standard. For front and rear terminals add B to model no. and $5 to price.
[4] 100 ohms/volt programming is standard. Add $25 for 1,000 ohms per volt programming. On PR units equipped for 1000 ohms/volt programming, panel controls are not available.
[5] For portable model, add T to model no.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range with current control at not less than 20% of full rating above maximum anticipated working current.

Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied. Note that Model TR036-0.2M operates on 50 to 420 cps.

STABILITY: ±0.1% or 15 MV, whichever is greater, under fixed line, load, and temperature conditions for 8 hours after warmup.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

TEMPERATURE COEFFICIENT: 0.1% per degree C.

OUTPUT IMPEDANCE: 0.03 ohm at 1 kc; 0.1 ohm at 50 kc.

PROGRAMMING CONSTANT: 100 ohms per volt. 1,000 ohms per volt, optional extra.

OVERLOAD PROTECTION: Current limiting. Fused ac input and dc output.

SPECIAL CAPABILITIES

REMOTE SENSING: All models permit sensing of load variations at load terminals rather than at power supply terminals. Remote sensing compensates for regulation loss that might result from IR drop in load leads and thus insures regulation directly at load. Models rated at 0.5 A or more permit remote sensing of IR drop in positive and negative leads. Models rated below 0.5 A permit remote sensing of IR drop in positive lead only.

SERIES AND PARALLEL OPERATION: Series or parallel operation, permits stacking two or more power supplies for additive outputs.

PROGRAMMABLE: All models are programmable from zero to maximum rated voltage at zero to maximum rated current.

DESIGN FEATURES

MOUNTING: Two half-rack power supplies can be mounted side by side in a 19-inch rack using couplers.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

TERMINATIONS: Unless specified otherwise, TR models are supplied with front terminals only; PR models are supplied with front and rear terminals. Rear terminals are not available on TR portable models. Front terminals only are not available on PR models.

Front: Insulated 5-way binding posts.

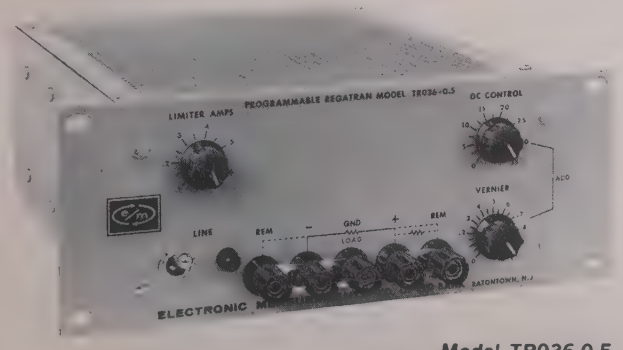
Rear: Barrier-type terminal strips.

Line Cord: 3-conductor type.

COOLING: Convection cooled, except Models TR018-1, TR036-0.5, TR212A, and TR224A which are forced air cooled.

ACCESSIBILITY: All models have removable top and bottom covers.

FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black and red screened panel markings.



Model TR036-0.5

For systems use, half-rack Regatran Power Supplies can save a lot of space. They are only 3½" high, and even the largest unit is just 12" deep. Couplers for mounting two half-rack power supplies side by side in a standard 19" rack are available at no cost.

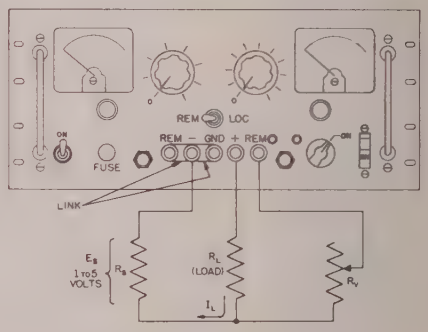
®Regatran "TO" Power Supplies

Model TO14-3M

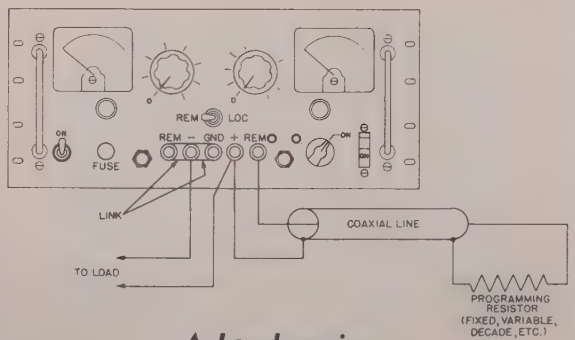
- *Super-Regulated*
- *All Solid-State*
- *Remote Sensing*
- *Programmable*
- *Electronic Circuit Breaker*

Model TO10-100M

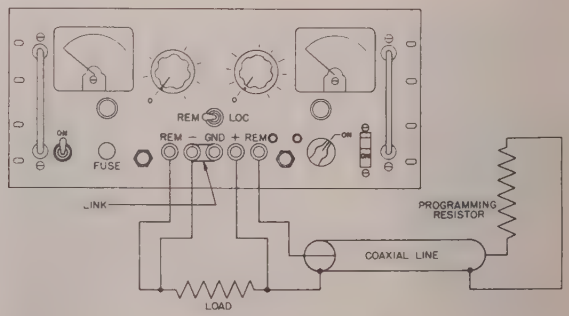
Conversion to constant-current operation.



Programmed Operation



A. Local sensing



B. Remote sensing

PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

TO SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS VOLTS		REGULATION	RIPPLE	TRANSIENT RESPONSE OUTPUT RECOVERS		AC INPUT 50-63 CPS 1φ A=105-125V B=198-242V	WATTS[1] INPUT	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE [2,3,4]	MODEL NO.[3]
VOLTAGE	AMPS	MAIN	FINE		MV	TO MV	WITHIN μSEC		APPROX.	H	W	D	APPROX.		WITH METERS 2% ACC. F.S.
0-6	0-120	0-6	0-0.25		2	[6]	[6]	A OR B	1120	15¾	19	16½	147	$1175	T06-120M
0-10	0-100	0-10	0-0.25		2	[6]	[6]	A OR B	1400	15¾	19	16½	147	1175	T010-100M
0-14	0-3	0-14	0-1		0.5	15	80	A OR B	116	3½	19	13	22	295	T014-3M*
0-14	0-5	0-14	0-1		1	15	80	A OR B	170	5¼	19	15¼	30	390	T014-5M*
0-14	0-7.5	0-14	0-1		1	40	100	A OR B	246	7	19	16½	48	420	T014-7.5M*
0-14	0-10	0-14	0-1		1	75	80	A OR B	294	8¾	19	16½	57	475	T014-10M*
0-16	0-60	0-16	0-0.5	10 MV	2	[6]	[6]	A OR B	1382	15¾	19	16½	137	1175	T016-60M
0-36	0-3	0-36	0-1	LINE	0.5	15	80	A ONLY	214	3½	19	13	25	355	T036-3M
0-36	0-5	0-36	0-1	OR	1	15	80	A OR B	370	5¼	19	15¼	40	435[5]	T036-5M
0-36	0-10	0-36	0-1	LOAD	1	40	100	A OR B	656	7	19	16½	61	520	T036-10M
0-36	0-15	0-36	0-1		1	75	80	A OR B	970	8¾	19	16½	72	650	T036-15M
0-36	0-30	0-36	0-1		1	150	100	A OR B	1930	15¾	19	16½	137	995	T036-30M
0-50	0-20	0-50	0-1		1	150	100	A OR B	1225	15¾	19	16½	135	995	T050-20M
0-60	0-1.5	0-60	0-1.		0.5	15	80	A ONLY	218	3½	19	13	25	355	T060-1.5M
0-60	0-2.5	0-60	0-1		1	20	100	A OR B	410	5¼	19	15¼	40	435[5]	T060-2.5M
0-60	0-5	0-60	0-1		1	40	100	A OR B	598	7	19	16½	61	475	T060-5M
0-60	0-7.5	0-60	0-1		1	75	80	A OR B	850	8¾	19	16½	72	675	T060-7.5M
0-60	0-15	0-60	0-1		1	150	100	A OR B	1650	15¾	19	16½	135	995	T060-15M
0-100	0-10	0-100	0-1		1	150	100	A OR B	1422	15¾	19	16½	147	1175	T0100-10M

[1] At max. input line voltage.
[2] For basic unit without meters, deduct $25 from price and delete M from model no.
[3] Front terminals only are standard. For front and rear terminals, add B to model no. and $5 to price ($20 for T06-120M, T010-100M, T016-60M).
[4] For 0.01% or 3 mv (whichever is greater) line or load regulation, add $75 to price. Not available on Models TO14-3, TO36-3, and TO60-1.5.
[5] For 220 V. input, add $30 to price.
[6] Not available at time of printing.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range.

Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground, or floating output.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase, except for Models T036-3M and T060-1.5M, which are available for 105 to 125 V only. Unless specified, the 105 to 125 V version is supplied.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

OUTPUT IMPEDANCE: Approximately 0.001 ohm at 1 kc to 0.2 ohm at 100 kc.

***PROGRAMMING CONSTANT:** 100 ohms per volt. Models designated (*) in table are fully programmable.

MHOGRAMMING CONSTANT: Available upon request. Can be made to fit users' requirements.

OVERLOAD PROTECTION: Electronic and magnetic circuit breakers except for 3-ampere models which have electronic circuit breaker only, with dc output fused. Fused ac input on all models.

SPECIAL CAPABILITIES

REMOTE SENSING: All models permit sensing of load variations at load terminals rather than at power supply terminals. Remote sensing compensates for regulation loss that might result from IR drop in load leads and thus insures regulation directly at load.

***PROGRAMMABLE:** Models designated (*) are programmable from zero to maximum voltage at zero to maximum current. Other models use variac input and require current derating for zero-to-maximum programming. Consult factory for derating information.

***MHOGRAMMABLE:** Most models are available for Mhogrammed control on special order. Models designated (*) are Mhogrammable from zero to maximum voltage at 0 to maximum current. Other models use variac input and require derating for zero to maximum Mhogramming. Specifications apply from 10% to 100% of rated voltage.

DESIGN FEATURES

MOUNTING: Units fit 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

ADJUSTMENTS: Null and calibration screwdriver adjust controls on front panel, except internal on 3½" panel height units.

TERMINATIONS: Unless specified otherwise, front terminals only are supplied.

Front: Insulated, 5-way binding posts except for Models T06-120M, T010-100M and T016-60M which have heavy-duty terminal blocks for POS and NEG terminals.

Rear: (Optional.) Barrier-type terminal strips except for Models T06-120M T010-100M and T016-60M which have heavy-duty terminal blocks for POS and NEG terminals.

Line Cord: 3-conductor type.

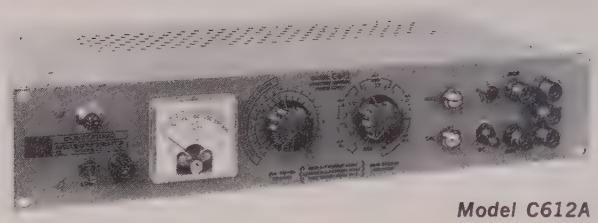
COOLING: Forced air.

ACCESSIBILITY: All models have removable top and bottom covers and plug-in transistor heat sink assemblies, except for models 3½" high.

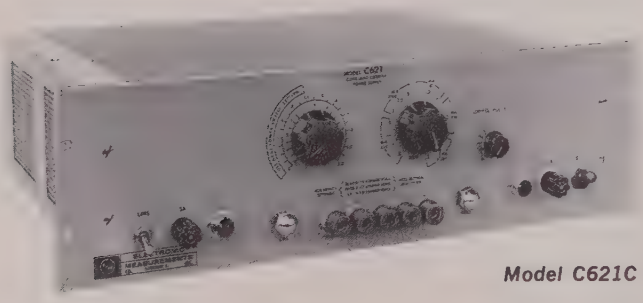
FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black, screened panel markings.

®Regatron Constant-Current "C600" Power Supplies

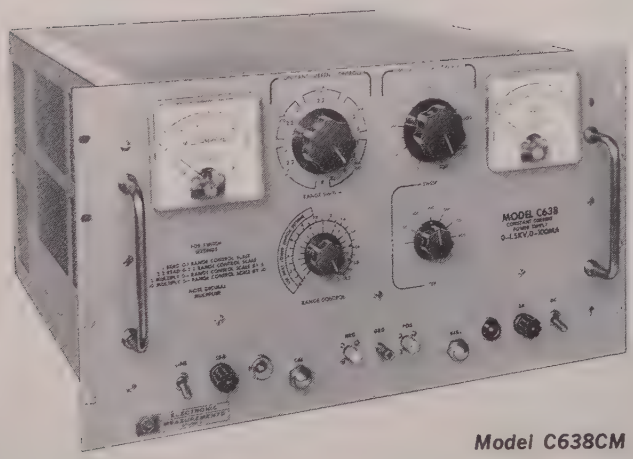
- *Constant Current/Voltage Control*
- *Constant Current From Less Than 0.5 Microampere Up To 3 A.*
- *Vacuum Tube Circuitry For Voltage Compliances Up To 2100 V*
- *Programmable*



Model C612A



Model C621C



Model C638CM

Constant Current Power Supplies are used in a wide variety of applications. Semiconductor applications include measurement of peak inverse voltage of solid state junctions, transistor leakage measurements, testing of reference diodes for voltage ratings and dynamic impedance, and employment as dc potential sources for transistorized circuits—for which they are often inherently better suited than voltage regulated power supplies. In magnetics, constant-current power supplies are utilized for ampere-turns control in the generation of magnetic fields, in testing relays, and as power sources for dc gyromotors and torquers requiring precise rpm control. Further applications include checking of gas tubes for operating voltage, calibration of dc ammeters, and arc production in gaseous breakdown devices.

Model C638CM shown at left will deliver up to 1500 V DC at any output current from a few microamperes up to 100 MA. There are other features too . . . a modulation input, programmability, and a voltage compliance control that permits setting the maximum voltage compliance. It also permits constant voltage operation.

PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

CONSTANT CURRENT C600 SERIES . . . SPECIFICATION TABLE

DC OUTPUT			OUTPUT CONTROLS			REGULATION		RIPPLE 0.04% OF SET. PLUS		TRANS. RESP.	AC INPUT 50-63 CPS, 1φ A=105-125 V B=198-242 V	WATTS[1] INPUT	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE[2,3]	MODEL NO.
CURRENT	VOLTS TO FULL RATED I	VOLTS WITH DERATED I[5]	RANGE SELECTOR	RANGE SWEEP	VOLTAGE LIMITING	LINE	LOAD	NEG. GND.	POS. GND.	IN MSEC		APPROX.	H	W	D	APPROX.		WITH METERS 2% ACC. F.S.
1μA-100MA	0-100	100-260						0.5μA	0.1μA	3	A OR B	150	3½	19	9¼	15	$289	C612A[4]
1μA-100MA	1-300	300-420			ZERO			0.5μA	0.1μA	3	A OR B	245	5¼	19	15	40	409	C631CM
0.5μA-100MA	0-1500	1500-2100			TO			[6]	[6]	3	A OR B	1100	10½	19	16¾	80	1120	C638CM
2.2μA-220MA	0-100	100-260			COMPLIANCE			0.7μA	0.15μA	3	A OR B	175	3½	19	9¼	16	364	C624A[4]
2.2μA-220MA	0-300	300-420	16 RANGES		MAXIMUM.		0.1%	0.5μA	0.1μA	3	A OR B	255	5¼	19	15	40	424	C632CM
2.2μA-220MA	0-600	600-730	COVERING	ZERO	NOTE:	0.15%	FOR	1μA	0.2μA	3	A OR B	470	8¾	19	15	52	540	C636CM
2.2μA-300MA	0-150	150-205	FROM	TO	ALWAYS	FOR	ALL	1μA	0.2μA	3	A OR B	190	5¼	19	15	30	409	C629CM
2.2μA-300MA	0-300	300-420	MINIMUM	MAXIMUM	SET	ALL	MODELS	0.5μA	0.1μA	3	A OR B	320	5¼	19	15	40	464	C633CM
5μA-500MA	0-50	50-110	TO	OF	LIMITER	MODELS	EXCEPT	2μA	0.2μA	3	A OR B	180	5¼	19	15	30	474	C620CM
5μA-500MA	0-100	100-160	MAXIMUM	RANGE	TO 5V		0.2%	2μA	2μA	3	A OR B	200	5¼	19	15	30	504	C621CM
10μA-1A	0-50	50-115	OUTPUT	SELECTOR	ABOVE		ON	2μA	2μA	3	A OR B	340	5¼	19	15	45	520	C613CM
10μA-1A	0-100	100-170	CURRENT	SETTING	OPERATING		½μA,	2μA	2μA	3	A OR B	370	5¼	19	15	45	554	C614CM
10μA-1A	0-150	150-215	RANGE		VOLTAGE		1μA	4μA	4μA	3	A OR B	525	8¾	19	15	46	670	C628CM
10μA-1A	0-200	200-280			TO		AND	4μA	4μA	3	A OR B	625	8¾	19	15	46	770	C630CM
22μA-2A	0-75	75-150			MAINTAIN		2μA	8μA	8μA	3	A OR B	700	8¾	19	15	46	740	C625CM
22μA-2A	0-100	100-190			RATED		RANGES	8μA	8μA	3	A OR B	760	8¾	19	15	46	770	C626CM
22μA-3A	0-50	50-125			REG.			4μA	4μA	3	A OR B	1000	10½	19	16¾	77	890	C615CM
22μA-3A	0-100	100-170						4μA	4μA	3	A OR B	1175	10½	19	16¾	77	940	C618CM

[1] At max. input line voltage.
[2] For basic unit without meters, deduct $25 from price and delete M from model no.
[3] For chopper stabilization, add $95 to price and K to model no.
[4] With panel voltmeter only (no ammeter). Available with voltage limiter, but with either panel voltmeter or front terminals eliminated. Add $50.
[5] Refer to curves for derated I operation.
[6] Not available at time of printing.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.) All regulation measurements made with range sweep control set to maximum.

Load: Current regulation measured for a 100 V step change, increase or decrease.

Line: Current regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative input. Double specification for 220-V operation. Model C638CM ripple corresponds to 0.04% of range setting +1 μA for positive ground and +0.5 μA for negative ground on ranges to 10 μA. On all other ranges ripple is less than 0.04% of range setting +2 μA.

TRANSIENT RESPONSE: (See table.) Within time specified to recover to within regulation limits for step change from 0 to 100 or 100 to 0 V.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified the 115 V version is supplied.

STABILITY:

C600's: 0.3% of range selector setting under fixed line, load, and temperature conditions for 8 hours after warmup.

C600K's: 0.2% of range selector setting under fixed line, load, and temperature conditions for 8 hours after warmup.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

TEMPERATURE COEFFICIENT: 0.08% per degree C.

OUTPUT IMPEDANCE: Varies linearly from approximately 30,000 megohms at 1 μA to 30 K ohms at 3 A.

PROGRAMMING CONSTANT: 200 micromhos per MA of output.

OVERLOAD PROTECTION: Fused ac input and dc output. Voltage limiting is a standard feature, except on Models C612A and C624A where voltage limiting is optional.

SPECIAL CAPABILITIES

PROGRAMMABLE: All models are programmable from zero to maximum rated current at zero to maximum rated voltage.

MODULATION INPUT: Permits use of constant-current power supplies as general-purpose or operational amplifiers capable of substantial gain and power output. Consult factory for modulation parameters.

VOLTAGE LIMITER: Units with voltage limiter can be used as constant-voltage units.

HIGHER VOLTAGE COMPLIANCE: See curves on Page 16 for maximum voltage compliance at below maximum current output.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS: Range selector switch and range sweep control. All controls are wirewound, except for voltage limiter.

ADJUSTMENTS: Null and calibration screwdriver adjust controls on front panel.

TERMINATIONS: Unless specified otherwise, both front and rear terminals are supplied.

Front: Insulated 5-way binding posts (BNC's on Model C638CM).

Rear: Barrier-type terminal strips.

Line cord: 3-conductor type.

COOLING: Forced air or convection cooling, depending upon model.

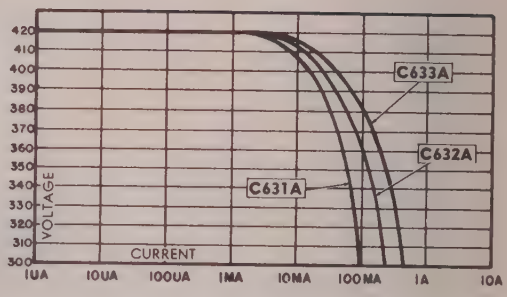
ACCESSIBILITY: All models have removable top and bottom covers.

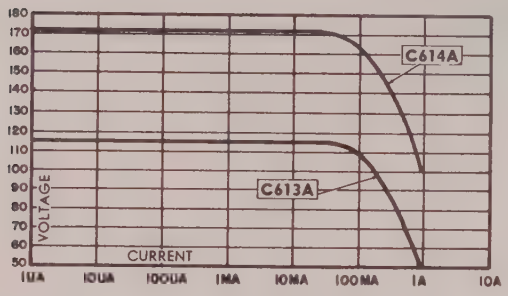
FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black and red screened panel markings.

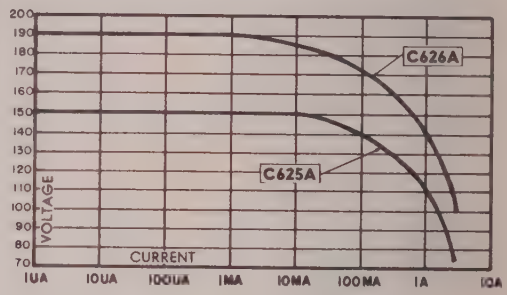
VOLTAGE COMPLIANCE CURVES

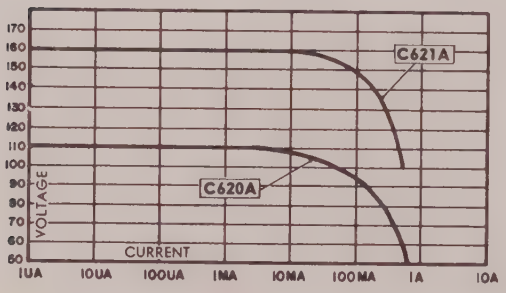
®Regatron Constant-Current "C600" Power Supplies

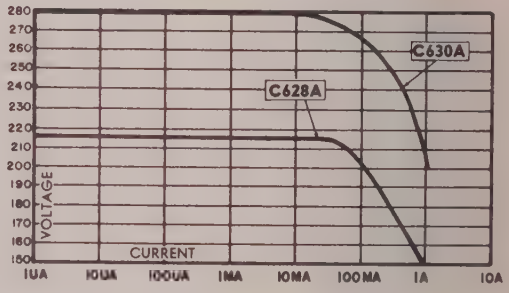
Voltage compliance, defined as the load voltage capability of a constant-current power supply, is analogous to maximum current rating for a voltage regulated unit. These graphs of voltage compliance indicate that actual compliances far exceed the nominal compliances when current output is below maximum.

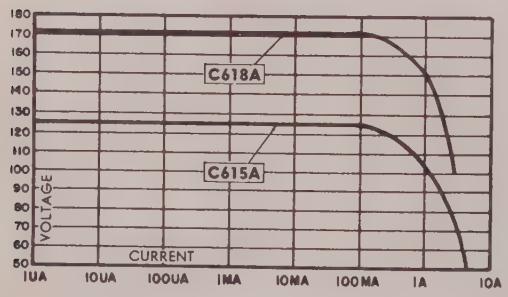


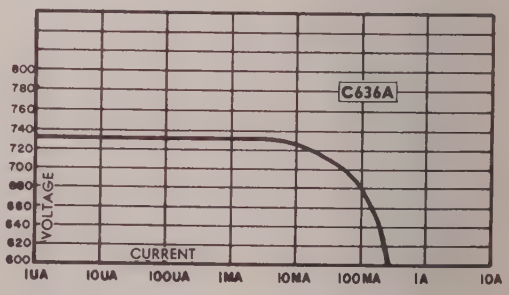


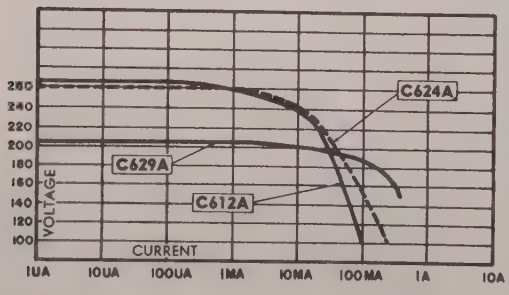


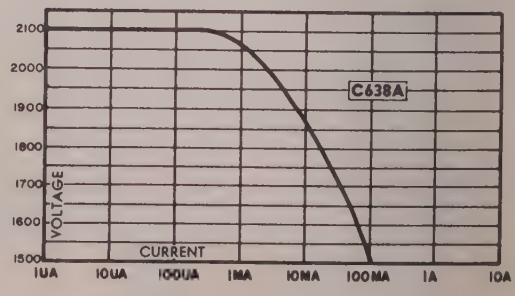








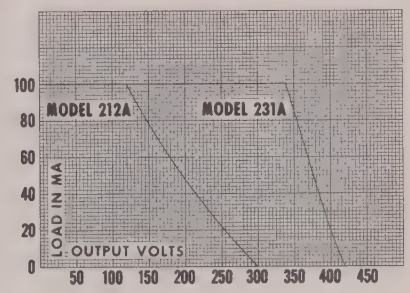


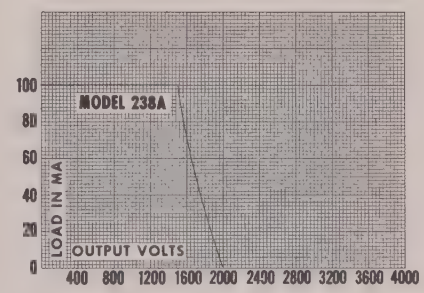


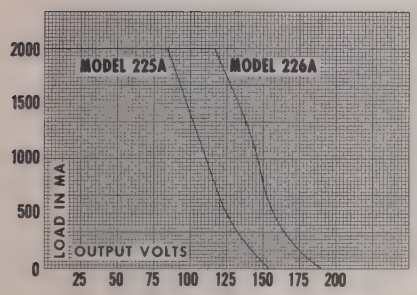
PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

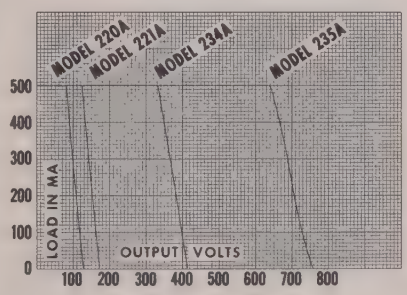
OVERVOLTAGE CAPABILITY CURVES
®Regatron "200" Power Supplies

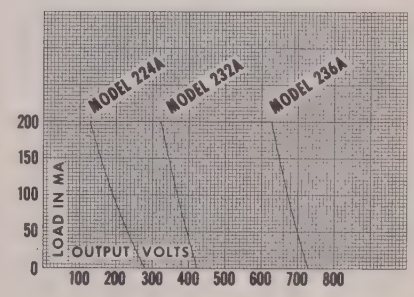
Programmable Regatrons are capable of voltage outputs far exceeding their specification limits, at reduced current levels. For overvoltage, an external programming resistor substitutes for or adds to the resistance of the internal controls, extending the control resistance range, and therefore the output range, in a simple, linear relationship. These graphs show the current ratings of Regatrons in overvoltage operation. For example, at 250 volts, Model 212A delivers up to 20 milliamperes. This output would be obtained by setting the output controls to zero and shunting a 250,000 ohm resistor across the REM and + terminals. Alternatively, the controls could be set for 100 volts, with an external 150,000 ohm resitor across the programming terminals.

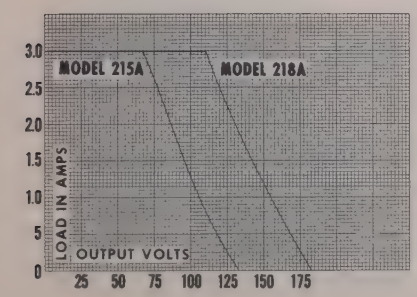


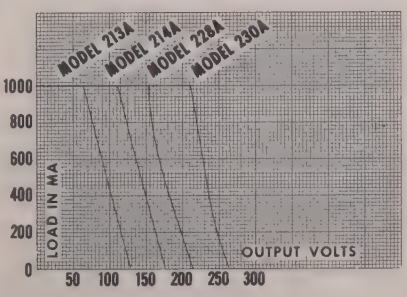


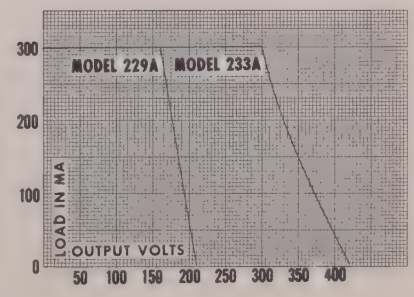




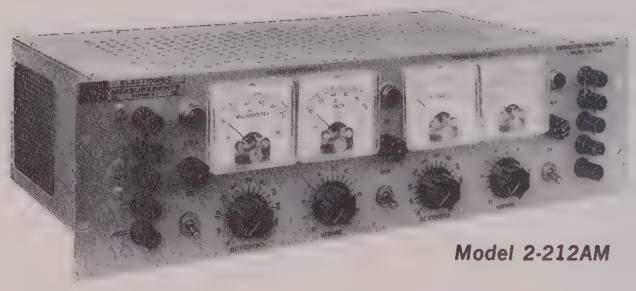






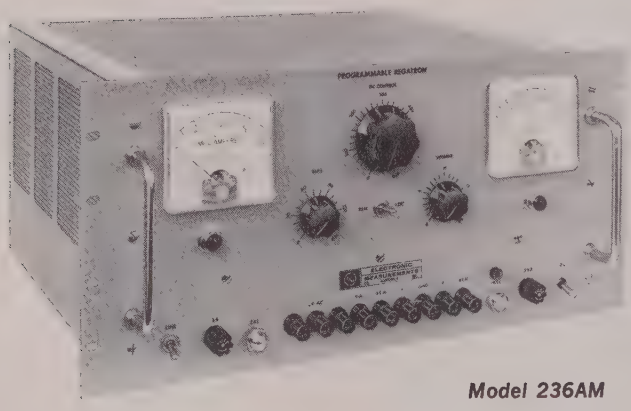


Regatron® "200" Power Supplies



Model 2-212AM

- *Programmable*
- *Mhogrammable®*
- *Remote Sensing*
- *Available with Chopper Stabilization*
- *Vernier Voltage Control*

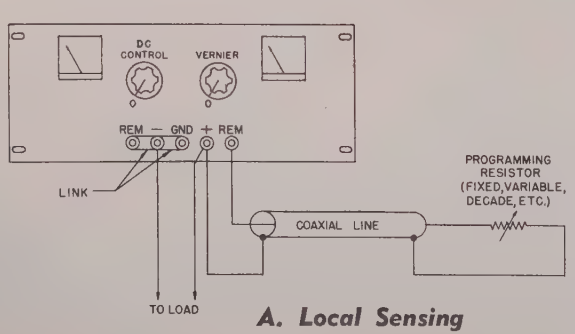


Model 236AM

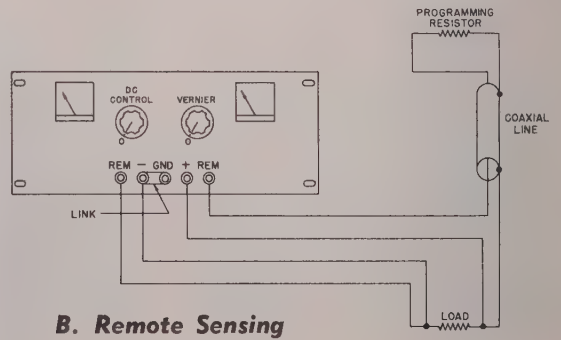
Operation Above Maximum Rating

When the output voltage of a Regatron Programmable Power Supply is controlled by means of an external resistor, it is possible to obtain greater voltages than the listed maximum. For example, in a Model such as the 212A, rated at 0—100 V, voltages approaching 300 V may be obtained. At these above-rating outputs, the available maximum current will be less than listed. Voltage vs. current graphs for all models are to be found on Page 17.

PROGRAMMED OPERATION



A. Local Sensing



B. Remote Sensing

PHONE: (201) 542-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

200 SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROLS		REGULATION[1]								RIPPLE	TRANS. RESP.	AC INPUT	WATTS[2] INPUT	DIMENSIONS			WEIGHT IN LBS.	PRICE[3,10]		MODEL NO.
				200 AM'S				200 AMK'S								DEPTH MEASURED BEHIND PANEL						
		VOLTS		LINE		LOAD		LINE		LOAD				50-63 CPS ↺ A=105-125 V B=198-242 V						200 AM'S	200 AMK'S	WITH METERS 2% ACC. F.S.
VOLTS	CURRENT	MAIN	FINE	%	MV	%	MV	%	MV	%	MV	MV	IN MSEC		APPROX.	H	W	D	APPROX.			
0-50	0-500MA	0-50	0-10	0.06	30	0.06	30	0.01	3	0.01	3	1	1	A OR B	205	5¼	19	12½	26	$324	$419	220AM
0-50	0-1A	0-50	0-10	0.06	30	0.01	30	0.01	3	0.01	3	1	1	A OR B	324	7	19	11½	35	370	465	213AM
0-50	0-3A	0-50	0-10	0.06	30	0.1	30	0.01	3	0.01	3	1	1	A OR B	992	10½	19	16¾	77	695	790	215AM
0-75	0-2A	0-75	0-10	0.06	30	0.06	30	0.01	3	0.01	3	1	1	A OR B	680	8¾	19	14 5/16	46	545	640	225AM
0-100	0-100MA	0-100	0-10	0.1	50	0.05	30	0.01	3	0.01	3	0.5	1	A OR B	97	3½	19	9½	13	154	249	212AM[5]
0-100	0-100MA	0-100	0-10	0.1	50	0.05	30	0.01	3	0.01	3	1	1	A OR B	194	5¼	19	9½	20	308	498	2-212AM[5,7]
0-100	0-200MA	0-100	0-10	0.1	50	0.05	30	0.01	3	0.01	3	1	1	A OR B	132	3½	19	9½	15	214	309	224AM[5]
0-100	0-500MA	0-100	0-10	0.04	30	0.04	30	0.01	3	0.01	3	1	1	A OR B	234	5¼	19	12¾	26	354	449	221AM
0-100	0-1A	0-100	0-10	0.05	30	0.05	30	0.01	3	0.01	3	1	1	A OR B	377	7	19	11½	35	404	499	214AM
0-100	0-2A	0-100	0-10	0.05	30	0.04	30	0.01	3	0.01	3	1	1	A OR B	740	8¾	19	14½	46	575	670	226AM
0-100	0-3A	0-100	0-10	0.06	30	0.04	30	0.01	3	0.01	3	1	1	A OR B	1155	10½	19	16¾	77	745	840	218AM
0-150	0-300MA	0-150	0-50	0.05	30	0.04	30	0.01	3	0.01	3	1	1	A OR B	193	5¼	19	12¾	26	259	354	229AM
0-150	0-1A	0-150	0-10	0.05	30	0.04	30	0.01	3	0.01	3	1	1	A OR B	510	8¾	19	14½	45	475	570	228AM
0-200	0-1A	0-200	0-10	0.05	30	0.04	30	0.01	3	0.01	3	1	0.5	A OR B	600	8¾	19	14½	46	575	670	230AM
0-300	0-100MA	0-300	0-30	0.08	60	0.02	40	0.01	3	0.01	3	1	0.5	A OR B	178	7	19	11½	37	239	334	231AM[4]
0-150	0-5MA	0-150	None	0.5	—	0.5[11]	—	0.5	—	0.5[11]	—	3										
6.3 AC	0-6A	None	None	—	—	—	—	—	—	—	—	—										
0-300	0-200MA	0-300	0-30	0.08	60	0.02	40	0.01	3	0.01	3	1	0.5	A OR B	256	7	19	11½	37	259	354	232AM[4]
0-150	0-5MA	0-150	None	0.5	—	0.5[11]	—	0.5	—	0.5[11]	—	3										
6.3 AC	0-6A	None	None	—	—	—	—	—	—	—	—	—										
0-300	0-300MA	0-300	0-30	0.08	60	0.02	40	0.01	3	0.01	3	1	0.5	A OR B	320	7	19	11½	37	279	374	233AM[4]
0-150	0-5MA	0-150	None	0.5	—	0.5[11]	—	0.5	—	0.5[11]	—	3										
6.3 AC	0-6A	None	None	—	—	—	—	—	—	—	—	—										
0-300	0-500MA	0-300	0-30	0.08	50	0.02	40	0.01	3	0.01	3	1	0.5	A OR B	438	7	19	11½	41	394	489	234AM
0-600	0-200MA	0-600	0-20	0.025	30	0.02	30	0.01	3	0.01	3	1	0.5	A OR B	450	8¾	19	15	52	350	445	236AM[8]
0-150	0-5MA	0-150	None	0.5	—	0.5[11]	—	0.5	—	0.5[11]	—	3										
6.3 AC	0-10A	None	None	—	—	—	—	—	—	—	—	—										
0-600	0-500MA	0-600	0-20	0.025	30	0.02	30	0.01	3	0.01	3	1	0.5	A OR B	802	10½	19	16¾	78	650	745	235AM[8]
0-1500	0-100MA	0-1500	0-30	0.04	20	0.04	20	0.01	3	0.01	3	1	0.5	A OR B	1155	10½	19	16¼	78	855	950	238AM[6]

[1] % or mv, whichever is greater.
[2] At max. input line voltage.
[3] For basic unit without meters, deduct $25 from price and delete M from model no. (Model 2-212A, deduct $50).
[4] Open construction for rack mounting. For table mounted unit with cabinet add T to model no. and $15 to price.
[5] Has modulation input.
[6] With current limiter control.
[7] Equivalent to two Model 212AM's. Outputs may be used in series, parallel, or independently. Specifications apply to each output.
[8] Available without panel controls, for 1000 ohms/volt programming, on special order, at no change in price.
[9] Not available at time of printing.
[10] Front terminals standard. For front and rear terminals (standard for Model 238AM) add B to model no. and add $5 to price. ($10 for Model 2-212AM).
[11] At 150 V.

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)
Load: Voltage regulation measured for a no-load to full-load or full-load to no-load change anywhere within range.
Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied.

STABILITY:
200A's: 0.1% or 50 MV, whichever is greater, for 8 hours after warmup under fixed line, load, and temperature conditions, using a precision, high-stability, external programming resistor.
200AK's: 0.05% +2 MV for 8 hours after warmup under fixed line, load, and temperature conditions, using a precision high-stability, external programming resistor.

TEMPERATURE RANGE:
Operating: 0° to +50° C.
Nonoperating: −40° to +75° C.

OUTPUT IMPEDANCE: Less than 0.01 ohm at low audio frequencies; 0.1 ohm to 10 kc; 1 ohm from 10 kc to 40 kc.

PROGRAMMING CONSTANT: 1000 ohms per volt, except models 235AM, 236AM, and 238AM which are 500 ohms per volt.

MHOGRAMMING CONSTANT: Available upon request. Can be made to fit users' requirements.

OVERLOAD PROTECTION: Fused ac input and dc output.

SPECIAL CAPABILITIES

REMOTE SENSING: All models permit sensing of load variations at load terminals rather than at power supply terminals. Remote sensing compensates for regulation loss that might result from IR drop in load leads and thus insures regulation directly at load. Models 212A, 2-212A, 224A, permit remote sensing for compensation of IR drop in positive output lead only.

PROGRAMMABLE: All models are programmable from zero to maximum rated voltage at zero to maximum rated current.

MHOGRAMMABLE: Consult factory.

EXTERNAL REFERENCE: Rear terminals provided for substituting external reference voltage for internal reference voltage except on Models 212AM, 2-212AM, 224AM, and 238AM.

OVERVOLTAGE CAPABILITY: Output voltages exceeding the values given in the table are available at reduced currents. See page 17 for Overvoltage Curves.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS: Wirewound type. Dial calibrations approximate.

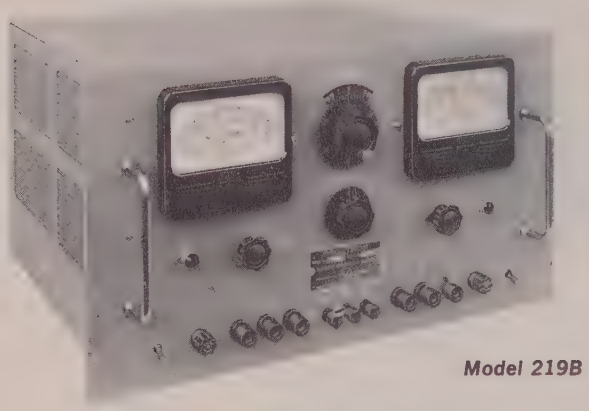
ADJUSTMENTS: Null and calibration controls on front panel, except internal on models 212A, 2-212A, and 224A.

TERMINATIONS: Unless specified otherwise, front terminals only are supplied, except for Model 238AM for which front and rear are standard.
Front: Insulated, 5-way binding posts (BNC's on Model 238AM).
Rear: Barrier-type terminal strips.

ACCESSIBILITY: All models have removable top and bottom covers, except for Models 231A, 232A, and 233A, which are open construction for rack mounting.

FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black and/or red screened panel markings.

Regatron® Precision-Calibrated Power Supplies



Model 219B

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range.

Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac or 198 to 242 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

TRANSIENT RESPONSE: (See table.) For a step change from no-load to full-load or full-load to no-load, output recovers within regulation limits within specified time.

AC INPUT: Either 105 to 125 V or 198 to 242 V, 50 to 63 cps, single phase. Unless specified, the 105 to 125 V version is supplied.

STABILITY: (For decade-controlled units.) 0.05% +2 MV, whichever is greater for 8 hours after warmup under fixed line, load, and temperature conditions.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

OUTPUT IMPEDANCE: 0.01 ohm to 1 kc; 0.1 ohm to 10 kc; 2 ohms to 100 kc.

DIAL CALIBRATION ACCURACY:

Decade-controlled units:

Decades: Within 0.1% or 0.025 V, whichever is greater.

Vernier: ±5%, corresponding to 0.050 V at maximum.

Continuous-controlled units:

0.25% or 0.3 V, whichever is greater. (0.25% or 0.5 V for Model 222A.)

OVERLOAD PROTECTION: Fused ac input and dc output.

SPECIAL CAPABILITIES

EXTERNAL REFERENCE: (Decade-controlled units.) Provided with rear terminals for substituting external reference voltage for internal reference voltage.

MODULATION INPUT: Models 209B and 219B have modulation input terminals for superimposing ac signals on regulated dc outputs.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

OUTPUT CONTROLS:

Decade-controlled units: Three decades permit selection of output between 0 and 300 volts in 1 V steps. Vernier range from 0 to 1 V.

Continuously-controlled units: Wirewound ten-turn main dc controls. Model 222A has numerical readout. Other models use dial presentation. All have wirewound one-turn verniers.

ADJUSTMENTS: Null and calibration controls.

TERMINATIONS: Unless specified otherwise, front terminals only are supplied.

Front: Insulated 5-way binding posts.

Rear: (Decade-controlled units only.) Barrier-type terminal strip for external reference provision.

Line cord: 3-conductor type.

COOLING: Forced-air cooling.

ACCESSIBILITY: All models have removable top and bottom covers.

FINISH:

Decade-controlled units: Smooth gray semigloss enamel. Class 2 per MIL-E-15090. Black screened panel markings.

Continuously-controlled units: Federal gray wrinkle finish. Engraved panel markings.

PRECISION SERIES . . . SPECIFICATION TABLE

DECADE CONTROL MODELS

DC OUTPUT		OUTPUT CONTROLS		REGULATION[1]		RIPPLE	TRANSIENT RESPONSE	AC INPUT 50-63 CPS 1φ A=105-125 V B=198-242 V	WATTS INPUT	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE	MODEL NO.[2]
VOLTS	CURRENT	MAIN 3-DECADES	FINE	%	MV	MV	MSEC		APPROX.	H	W	D	APPROX.		
0-300	0-100MA	0-300	0-1	0.01	1	3	0.5	A OR B	178	7	19	11	33	$429	2601AK
0-300	0-200MA	0-300	0-1	0.01	1	3	0.5	A OR B	256	7	19	11	33	449	2602AK
0-300	0-300MA	0-300	0-1	0.01	1	3	0.5	A OR B	320	7	19	11	33	469	2603AK

CONTINUOUS CONTROL MODELS

DC OUTPUT		OUTPUT CONTROLS		REGULATION[1]				RIPPLE	TRANSIENT RESPONSE	AC INPUT 50-63 CPS 1φ A=105-125 V B=198-242 V	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE	MODEL NO.
				LINE		LOAD										WITH METERS
VOLTS	CURRENT	MAIN	FINE	%	V	%	V	MV	MSEC		H	W	D	APPROX.		2% ACC. F.S.
0-600	0-600MA	0-600	0-3	0.02	0.05	0.01	0.02	0.5	2	A OR B	10½	19	15	75	$525	209B
0-150	0-5MA	0-150	—	0.5	—	0.5[3]	—	0.5								
6.3 AC CT	10A	—	—	—	—	—	—	—								
0-600	0-1A	0-600	0-3	0.02	0.05	0.01	0.05	0.5	2	A OR B	10½	19	15	80	650	219B
0-150	0-5MA	0-150	—	0.5	—	0.5[3]	—	0.5								
6.3 AC CT	10A	—	—	—	—	—	—	—								
0-1000	0-500MA	0-1000	0-5	0.02	0.05	0.01	0.02	1	2	A OR B	10½	19	15	80	650	222A
0-300	0-5MA	0-300	—	0.02	0.05	0.01	0.02	1								
6.3 AC CT	10A	—	—	—	—	—	—	—								

[1] % or mv, whichever is greater. [2] With panel milliameter (2% accuracy full scale) [3] At 150 V.

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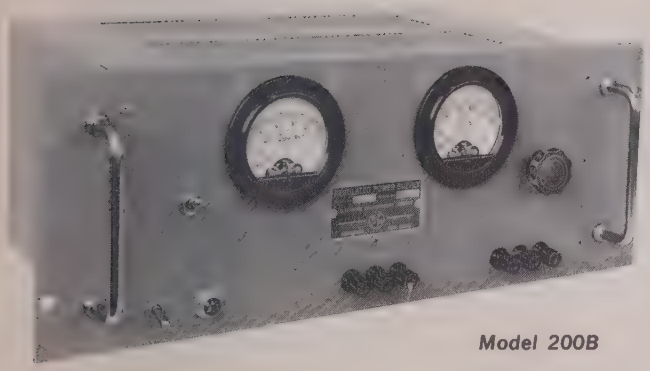
General Utility Power Supplies



Model 200B

- *Up to 500 V at 300 MA*
- *6.3 V AC Output*
- *Low Output Impedance*

ELECTRICAL SPECIFICATIONS

REGULATION: (See table.)

Load: Voltage regulation measured for a no-load to full-load or full-load to no-load step change anywhere within range.

Line: Voltage regulation measured for an input voltage step change of 105 to 125 V ac.

RIPPLE: (See table.) Maximum rms value with either positive or negative ground.

AC INPUT: 105 to 125 V, 50 to 63 cps, single phase.

TEMPERATURE RANGE:

Operating: 0° to +50° C.

Nonoperating: −40° to +75° C.

OUTPUT IMPEDANCE: 0.01 ohm to 1 kc; 0.1 ohm to 10 kc; 1 ohm to 100 kc.

OVERLOAD PROTECTION: Fused ac input and main dc output.

DESIGN FEATURES

MOUNTING: Units fit standard 19-inch rack and are equipped with rubber feet for table use.

TERMINATIONS: Both front and rear, unless otherwise specified.

Front: Insulated 5-way binding posts.

Rear: Octal socket on Model 200B; Jones-type socket on Models 204A and 204B.

Line Cord: 3-conductor type.

ACCESSIBILITY: All models have removable top and bottom covers.

FINISH: Federal gray wrinkle finish. Engraved panel markings.

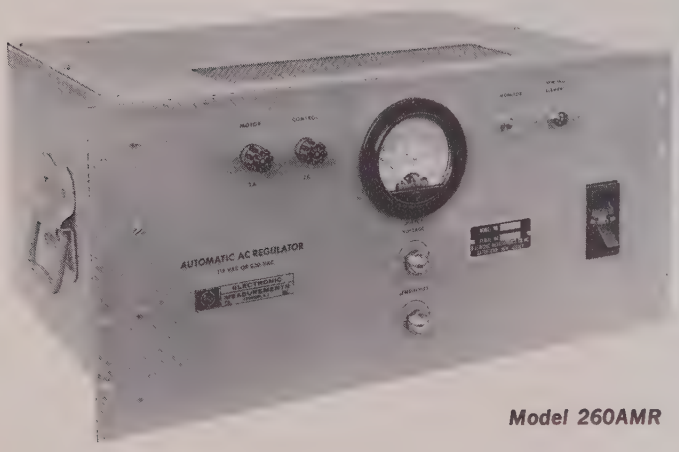
GENERAL UTILITY SERIES . . . SPECIFICATION TABLE

DC OUTPUT		OUTPUT CONTROL	REGULATION[1]				RIPPLE	AC INPUT 50-63 CPS 1φ A=105-125 V B=198-242 V	DIMENSIONS DEPTH MEASURED BEHIND PANEL			WEIGHT IN LBS.	PRICE	MODEL NO.
			LINE		LOAD									WITH METERS 2% ACC. F.S.
VOLTS	CURRENT	VOLTS	%	V	%	V	MV		H	W	D	APPROX.		
0-325 6.3 AC CT	0-125MA 6A	0-325	1	—	1	0.2	5	A ONLY	7	19	15	40	$185	200B
0-500 6.3 AC CT	0-300MA 10A	0-500	0.5	0.2	1	0.2	5	A ONLY	10½	19	15	71	360	204A
0-500 0-150 6.3 AC CT	0-300MA 0-5MA 10A	0-500 0-150	0.5 1	0.2 —	1 0.5[2]	0.2 —	5 5	A ONLY	10½	19	15	71	375	204AB

[1] % or mv, whichever is greater. [2] At 150 V.

AC Line-Voltage Regulator

115 V or 230 V operation . . . 6 kva capacity



Model 260AMR

Model 260AM

ELECTRICAL SPECIFICATIONS

NOMINAL INPUT: 115 or 230 V, 47 to 63 cps, single phase. Swinging links used to set unit for desired input.

OUTPUT: 110 to 120 V when connected for 115 V input. 220 to 240 V when connected for 230 V input.

POWER RATING: 6 kva for either input voltage and at any power factor. For 115 V use, unit can be reconnected to provide correction over input range of 90 to 140 V. In this case, power rating is 3 kva.

CONTROL RANGE:
115 V operation: Corrects for input varying ±15 V.
230 V operation: Corrects for input varying ±30 V.

CONTROL TOLERANCE: Control tolerance can be varied and set to value of better than ±1%. When connected to provide correction over input range of 90 to 140 V, control tolerance is approximately doubled.

CORRECTION RATE: Approximately 0.15 seconds per volt.

WAVE FORM DISTORTION: None

METER: Optional output calibrated 0 to 250 V ac.

TEMPERATURE RANGE:
Operating: —40° to +60° C.
Nonoperating: —55° to +71° C.

OVERLOAD PROTECTION: Monitor light indicator warns of improper operation. Fail-safe arrangement prevents over-voltage.

DESIGN FEATURES

CONTROLS: On-off line circuit breaker: OUTPUT VOLTAGE and SENSITIVITY screwdriver adjust controls also located on front panel.

TERMINATIONS: Input and output terminals through conduit hole.

REMOVABLE TOP AND BOTTOM COVERS: Rack model has removable top and bottom covers. Wall model has removable side panels.

FINISH: Smooth gray semigloss enamel, Class 2 per MIL-E-15090. Black panel markings.

DIMENSIONS:
Wall mounting: 13" W x 17" H x 8¾" D
Rack mounting: 19" W x 8¾" H x 13½" D

WEIGHT: Approximately 90 pounds.

MOUNTING: Wall mounting or rack mounting models. Please specify.

PRICE:
Model 260A (wall mounting) or *260AR* (rack mounting): $425.
Model 260AM or 260AMR (with panel output voltmeter): $445.

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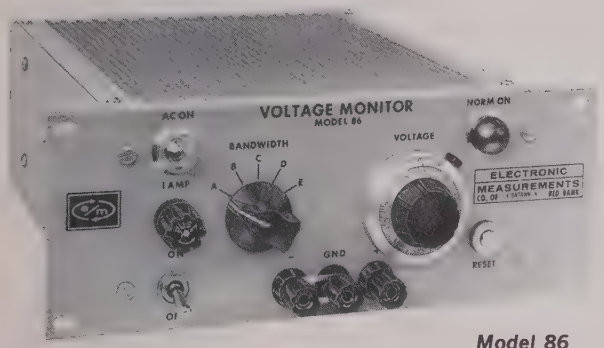
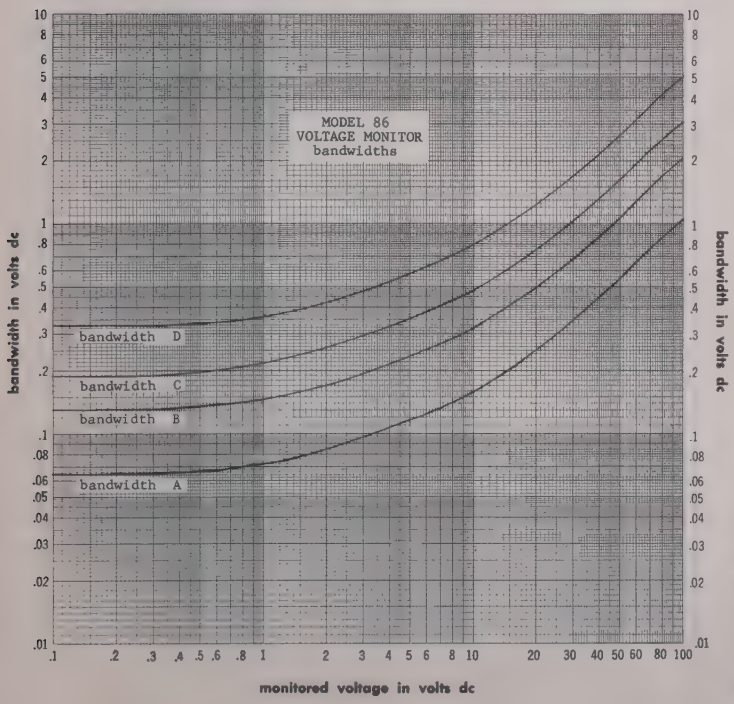
Model 86 Voltage Monitor



Model 86

FOR OVER AND UNDER VOLTAGE PROTECTION

PROTECTS COSTLY EQUIPMENT



ELECTRICAL SPECIFICATIONS

VOLTAGE RANGE: 0 to 100 V dc—programmable to higher voltage.

VOLTAGE BANDWIDTHS: Four bandwidths (See curves)
Bandwidths at 100 volts: ±1 V, ±2 V, ±3 V, ±5 V.
Bandwidths at close to 0 volts: ±70 MV, ±140 MV, ±210 MV, ±350 MV.
Bandwidths between 0 and 100 volts: See curves.
Bandwidth limits: Within ±20% of selected voltage value.

CALIBRATION ACCURACY: Uses ten-turn dial calibrated from 0 to 100 volts in 0.1-volt graduation. Calibration accuracy is approximately 0.25% of full scale.

TEMPERATURE RANGE:
Operating: 0° to 45° C.
Nonoperating: —40° to +75° C.

TEMPERATURE COEFFICIENT: 0.05% per degree C.

OPERATING SPEED: Relay mode: 20 msec. (Operating speeds to 20 usec may be obtained. Contact factory for further information).

AC INPUT: 115 V, 50 to 63 cps single phase.

LINE VOLTAGE STABILITY: Line voltage variations have negligible effect on equilibrium voltage and operating characteristics of monitor.

PROGRAMMING CONSTANT: 200 ohms per volt.

OVERLOAD PROTECTION: Input line fused.

SPECIAL CAPABILITIES

PROGRAMMABLE: Input dc voltage range can be extended or monitor can be used with programmed voltages by external resistor connected between (+) input terminal and (+) terminal of monitored supply.

PROVISION FOR EXTERNAL CIRCUITRY: Power relay with two form-C contacts normally incorporated. Relay contact rating: 20 A at 115 V ac. External connections made at rear of unit.

DESIGN FEATURES

CONTROLS: LINE switch, VOLTAGE control, RESET control, bandwidth selector switch.

TERMINATIONS:
Front: (Connections for monitored power supply only.) Insulated binding posts.
Rear: (Relay and protect-signal terminals and monitored power supply.) Barrier type terminal strips.
Line Cord: 3-conductor type.

ACCESSIBILITY: Removable top and bottom covers.

FINISH: Smooth gray semigloss enamel. Class 2 per MIL-E-15090.

MOUNTING: Half-rack type. Equipped with feet for table mounting.

DIMENSIONS: 3½" H x 9½" W x 10¼" D.

WEIGHT: 7 pounds (approx.).

PRICE: $225.

DEFINITIONS

CALIBRATION CONTROL (See Figure 1.)

The calibration control serves to calibrate the bridge circuits which will then provide the proper values of voltage with different settings of R1. Calibration usually takes the form of a small adjustment of R2.

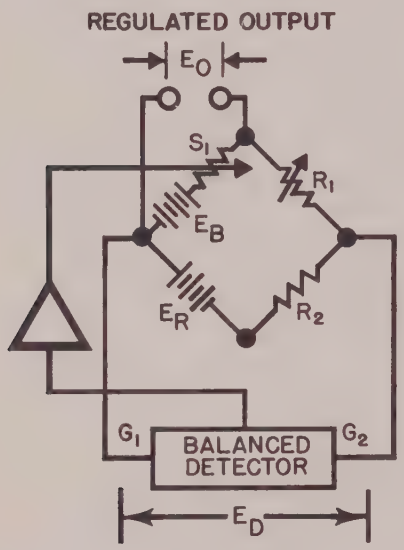


Figure 1

CONSTANT CURRENT POWER SUPPLY

A power supply that maintains a fixed current through a varying load. The power supply furnishes more voltage with increasing load resistances and less voltage with decreasing load resistances, thus maintaining the relationship $I_C = \frac{E_L}{R_L}$. Where I_C is the constant current and E_L is the variable voltage across the variable load R_L.

CONSTANT VOLTAGE POWER SUPPLY

A power supply that maintains a fixed voltage across a varying load. The power supply furnishes more current with decreasing load resistances and less currents with increasing load resistances, thus maintaining the relationship $E_C = I_L \times R_L$. Where E_C is the constant voltage and I_L is the variable current through the variable load R_L.

COOLING

Convection — In convection cooling no air-moving devices are employed. Rather, dependence is placed on the natural air motion around warm bodies due to the difference in temperature between the air immediately adjacent and the surrounding air.

Forced air — In forced air cooling, some device such as a fan or blower, is used to force air over the devices to be cooled. It is a very positive method and permits the air system to be designed for a desired temperature rise.

CROSSOVER (Voltage/Current or Current/Voltage) (See Figure 2.)

In a power supply, the automatic transfer from the constant voltage operating mode to the constant-current operating mode or vice versa. In any particular power supply, the point of crossover is established by the setting of the voltage and current output controls. The power supply will operate in the constant-voltage mode so long as the load current is less than the current control setting. It will transfer (crossover) to the constant-current mode when the load current reaches the level set by the current control. Conversely, it will crossover to the constant voltage mode when the load is decreased and the voltage reaches the level set by the voltage control. Thus, the crossover point is established by the setting of the voltage and current controls, which may be at any point within the ratings of the power supply.

It should be noted that a power supply with a limiter (either voltage or current) is actually a power supply capable of operating in either the constant-current or the constant-voltage mode. Power supplies that use independent regulating channels for the voltage and current have a very sharp crossover. Conventional regulating circuits provide a crossover with varying amounts of voltage and current differentials at the intersection. See Figure 2.

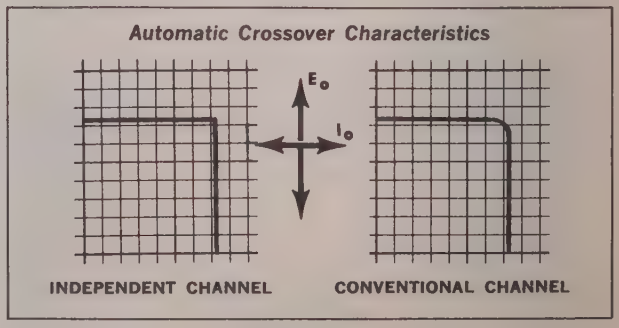


Figure 2

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EXTERNAL REFERENCE (Provisions for)

Power supplies so equipped can be connected to an external reference. For example, in systems use, a common external reference can be used for the system as well as for the power supply.

IMPEDANCE, OUTPUT

This is the incremental source impedance of the power supply. It is essentially $\frac{\triangle e}{\triangle i}$ for small signals. Expressed in ohms vs. frequency.

MODULATION

This refers to the property of a power supply which permits the output to be modulated by an external signal (usually some low frequency wave) such as a sine wave, ramp, etc. This capability is very useful in setting up test sequences in automatic equipment.

NULL CONTROL (See Figure 1.)

This control is used to set the balanced detector so that the input voltage E_D is zero at balance. When chopper stabilization is provided, this adjustment is made continuously and automatically.

REGULATION

Line — The maximum change in output voltage (or current) for a specified step change in input line voltage. Usually given for a 105 to 125V or 198 to 242V AC step change.

Load — The maximum change in output voltage (or current) for a specified step change in the load. Usually given for a no-load to full-load or full-load to no-load step change.

REMOTE CONTROL

This refers to the property of a power supply which permits it to be controlled at a distance. Thus, in Figure 1, lines can be extended from the power supply so that R1 is located at some distance (up to hundreds of feet) from the power supply.

Programming (with resistance) — The control of the output voltage by means of an external resistance element. The output voltage is directly proportional to the resistance value. (R_1 on Figure 1.)

Programming (with voltage) — The control of the output voltage by means of an external voltage. In this application the power supply serves as a current amplifier.

®Mhogramming — The control of the output voltage by means of an external resistance element. The output voltage is inversely proportional to the resistance value and proportional to the conductance. See Figure 3.

REMOTE SENSING

The capability of a power supply that permits connecting to the load in such a way that regulation occurs at the load. Remote sensing compensates for regulation loss that might result from IR drops in load leads.

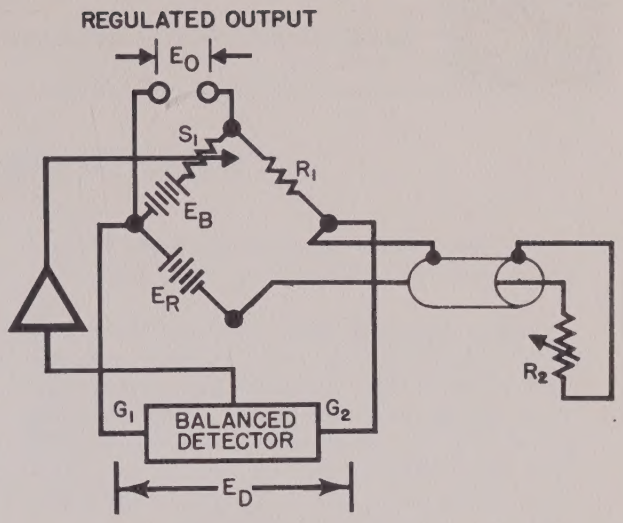

Figure 3

RIPPLE

The rms value of any AC component or noise on the DC output. Unless otherwise stated, the value is given with either the negative or the positive output terminal grounded.

SERIES AND/OR PARALLEL OPERATION

The stacking of two or more power supplies to combine the outputs. This procedure is similar to the connecting of several cells for greater voltage and/or current. Note that power supplies with this provision also permit connecting the units so that control is from just one unit. The controlling power supply is called the master; the controlled units are called the slaves.

STABILITY

The ability of a power supply to maintain a constant output voltage (or current) over a period of time under fixed conditions of input, load, and temperature—usually expressed in terms of a voltage (or current) change over a fixed length of time.

TEMPERATURE

Coefficient — The change in output voltage (or current), resulting from a change in operating temperature. Usually expressed as a % change per degree C.

Nonoperating — The ambient temperature range over which a power supply can be stored without damage due to overheating.

Operating — The ambient temperature range over which a power supply can be operated without failure due to overheating.

TRANSIENT RESPONSE

This refers to the time required for a power supply output to recover from a load perturbation, usually no-load to full-load or full-load to no-load.

PROGRAMMING SPEED

This note concerns programming speed and the means required to change it when necessary.

Programming speed refers to the time required for the output voltage to go from one value to another when controlled by an external programming resistor. Programming speed (sometimes called switching speed) must not be confused with transient recovery time, which refers to the time required for disturbances in the output voltage to subside after a step change in load current or line voltage.

The programming speeds of stock units vary from 5 milliseconds to a second, depending on model and rating. Also the figure for increasing voltage is generally different from the figure for decreasing voltage. In general, there are three principal time constants that affect the switching speed, as follows:

1. The feedback time constant at the input stage of the feedback loop amplifier.
2. The output system time constant (including load).
3. The time constant and gain of the loop amplifier.

Item 1 generally affects most importantly the time required to go from a lower to a higher voltage. The voltage progresses upward along an exponential path.

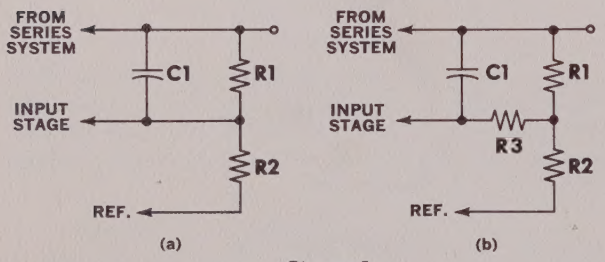

Figure 1

Figure 1 shows two possible input control configurations. The time constant in one case is determined by C1, R1, R2; in the second case by C1, R1, R2 and R3. R3 is employed where the value of R1 would require a capacitor of impractical size to achieve the desired time constant. A reduction of C1 will generally decrease the time required to go from a given voltage to a greater one. Although this network could also control the time in the decreasing direction, this is generally not the case, inasmuch as Item 2 is the determining factor, generally contributing much greater time delay.

Item 2 is largely influential in determining the programming time for voltages in a decreasing direction. The general configuration of the output system is shown in figure 2. It is to be noted that C2 (which may be one or more capacitors) is required to reduce the ac output impedance of the output system at frequencies where the amplifier is ineffective, and also as an adjustment of the phase-gain characteristics of the amplifier. In the interest of low impedance, C2 is generally (but not always) made very large. It is clear that the usual series element is not capable of passing current in both directions. Hence, when the output voltage is programmed from a higher to a lower value, the only path for discharge current from C2 is through the circuit resistors and the load resistor R_L.

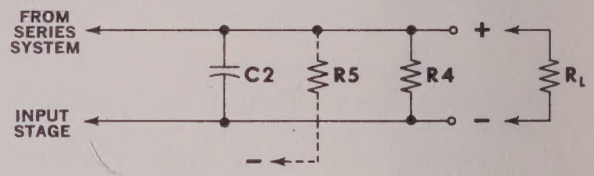

Figure 2

In the absence of load, the time constant determined by C2 and R4 can be long enough to require seconds for discharge. R5 provides a means for improving this situation and will be discussed below. It is clear that this time constant can be reduced by a reduction of C2 or a reduction of the resistance of R4. However, with a resistor across the output lines only, the decreasing voltage exponential is asymptotic to zero, and hence correction to a very small value of voltage may take a long time.

This is where R5 is helpful. If a discharge resistor is added from the positive line to a line having a potential more negative than the negative line, it is clear that the exponential will be asymptotic to a value lower than the minimum voltage to be reached, and hence will reach this point at greater slope. Although theoretically one may argue that these elements (Item 2) also contribute to the upward time constant, in practice this is seldom so, since, when fully enabled, the series system provides such a low series resistance that the lag provided by C2 is negligible in view of the other contributing factors.

Item 3 is seldom important for the reason that, for this item to be of significance, C1 must be eliminated, and in most instances, C2. Since it is seldom practical to design an amplifier without those elements (and still avoid instability), this case will not be given extended consideration.

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We will now consider separately the two cases where it is desired to change the upward voltage time constant and the case where it is desired to change the downward voltage time constant.

First consider the case where it is desired to increase the upward time constant. This is done in instances, for example, where it is desired to generate a ramp function. Where good linearity is required, the beginning portion of the exponential may be employed. In other cases most of the exponential may be employed. To increase this time constant it is merely necessary to increase C1. Where the value of C1 becomes impractical, Circuit 1b may be employed. Conversely, to decrease the time constant, C1 must be decreased. Where C1 is reduced appreciably increased output ripple may be encountered. It then behooves the designer to strike a compromise between increased ripple and programming time, if an acceptable one is available.

For the case where the downward programming time must be adjusted, C2 and R4 may be reduced or increased as required, with the following considerations kept in mind:

1. A reduction in C2 means higher output impedance and poorer transient performance.
2. R4 can be part of the useful load if it is not to be switched out of the circuit.
3. R5 may be advantageously employed providing that the current capability of the negative supply employed is never exceeded.

In general, most of the above changes can result in loop instability. In such instances some adjustment of phase gain characteristics will be required.

The following example illustrates what can be done by employing bias current from a negative bias voltage source.

Let starting $E_o = E_1$

Then,

$$E_o = E_1 e^{-\frac{T}{RC}} = 0.01E_1$$

for E_o to decrease to 1% of E.

Solving for T

$$-T = RC \log 0.01$$

Now add a bias voltage E_2 and return R to its negative terminal. The decay function for the total voltage E_o',

$$E_o' = E_T e^{-\frac{T}{RC}} \text{ where } E_T = E_1 + E_2$$

Then

$$E_o = E_o' - E_2$$
$$= E_T e^{-\frac{T}{RC}} - E_2$$

solving for T for $E_o = .01\ E_1$

$$RC \log (0.01\ E_1 + E_2) - \log E_T = -T$$

Assume $E_1 = 100$ volts
$R = 10{,}000\ \Omega$
$C = 10$ mfds

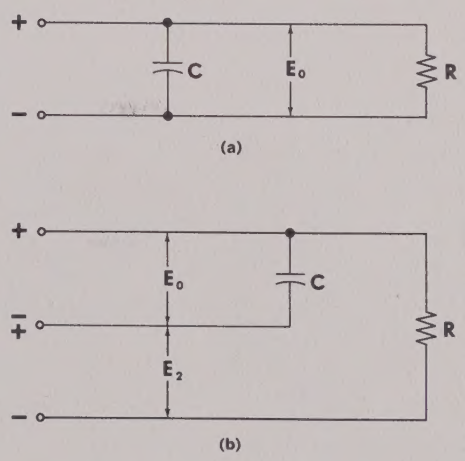

Figure 3

Then for case 1, (figure 3a),

$$-T = 10^4 \times 10 \times 10^{-6} \times (-4.6)$$
$$T = 0.45 \text{ sec.}$$

Reconnect for case 2, (figure 3b) (Let $E_2 = -100$).

Then

$$-T = 10^4 \times 10 \times 10^{-6}\ 4.610 - 5.299$$
$$T = 0.069 \text{ sec.}$$

Thus by the use of this arrangement a twofold increase in bias current produced a sixfold improvement in programming time. The improvement increases as the end voltage is made smaller (i.e<1%).

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